



Integrated Smart Array Controller

User Guide

First Edition (September 1999)
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Compaq Computer Corporation

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Compaq Integrated Smart Array Controller User Guide
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About This Guide

This guide is designed to be used as step-by-step instructions for installation and as a reference for operation, troubleshooting, and future upgrades.

Text Conventions

This document uses the following conventions to distinguish elements of text:

Keys	Keys appear in boldface. A plus sign (+) between two keys indicates that they should be pressed simultaneously.
USER INPUT	User input appears in a different typeface and in uppercase.
<i>FILENAMES</i>	File names appear in uppercase italics.
Menu Options, Command Names, Dialog Box Names	These elements appear in initial capital letters.
COMMANDS, DIRECTORY NAMES, and DRIVE NAMES	These elements appear in uppercase.
Type	When you are instructed to <i>type</i> information, type the information without pressing Enter .
Enter	When you are instructed to <i>enter</i> information, type the information and then press Enter .

Symbols in Text

These symbols may be found in the text of this guide. They have the following meanings.



WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life.



CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

IMPORTANT: Text set off in this manner presents clarifying information or specific instructions.

NOTE: Text set off in this manner presents commentary, sidelights, or interesting points of information.

Symbols on Equipment

These icons may be located on equipment in areas where hazardous conditions may exist.



Any surface or area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.

WARNING: To reduce the risk of injury from electrical shock hazards, do not open this enclosure.



Any RJ-45 receptacle marked with these symbols indicates a Network Interface Connection.

WARNING: To reduce the risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.



Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. If this surface is contacted, the potential for injury exists.

WARNING: To reduce the risk of injury from a hot component, allow the surface to cool before touching.



Power supplies or systems marked with these symbols indicate the equipment is supplied by multiple sources of power.

WARNING: To reduce the risk of injury from electrical shock, remove all power cords to completely disconnect power from the system.

Rack Stability



WARNING: To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
 - The full weight of the rack rests on the leveling jacks.
 - The stabilizing feet are attached to the rack if it is a single rack installation.
 - The racks are coupled together in multiple rack installations.
 - Only one component is extended at a time. A rack may become unstable if more than one component is extended for any reason.
-

Server Warnings and Precautions



22.6 kg
50 lb

WARNING: Any product or assembly marked with these symbols indicates that the component exceeds the recommended weight for one individual to handle safely.

WARNING: To reduce the risk of personal injury or damage to the equipment, observe local occupational health and safety requirements and guidelines for manual material handling.

Getting Help

If you have a problem and have exhausted the information in this guide, you can get further information and other help in the following locations.

Compaq Technical Support

In North America, call the Compaq Technical Phone Support Center at 1-800-OK-COMPAQ¹. This service is available 24 hours a day, 7 days a week.

Outside North America, call the nearest Compaq Technical Support Phone Center. Telephone numbers for worldwide Technical Support Centers are listed on the Compaq website. Access the Compaq website by logging on to the Internet:

<http://www.compaq.com>

Be sure to have the following information available before you call Compaq:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Add-on boards or hardware
- Third-party hardware or software
- Operating system type and revision level
- Detailed, specific questions

¹ For continuous quality improvement, calls may be recorded or monitored.

Compaq Website

The Compaq website has information on this product as well as the latest drivers and Flash ROM images. You can access the Compaq website by logging on to the Internet:

<http://www.compaq.com>

Compaq Authorized Reseller

For the name of your nearest Compaq authorized reseller:

- In the United States, call 1-800-345-1518.
- In Canada, call 1-800-263-5868.
- Elsewhere, see the Compaq website for locations and telephone numbers.

Chapter 1

Controller Features

The Compaq Integrated Smart Array Controller is a dual-channel, 32-bit PCI controller supporting RAID technology. It also supports Wide Ultra2 SCSI technology for faster data transfer rates and is backward compatible with Wide-Ultra SCSI-3 devices. The Integrated Smart Array Controller supports SCSI drives either through the external Wide-SCSI connector or the internal 68-pin Wide-SCSI connector, with a maximum of two supported channels. Configuring the server to use two separate SCSI ports provides maximum internal and external drive support without having to commit the resources of an expansion slot.

Standard Features

Features of the Compaq Integrated Smart Array Controller include:

- Support for RAID 0, RAID 1, RAID 0+1, and RAID 5
- Support for Wide Ultra2 SCSI technology and an improved data transfer rate maximum of 80 MB/s
- Backward compatible with Wide-Ultra SCSI-3 hard drives
- Support for offline drive and array movement
- Dual Wide Ultra2 SCSI channels supporting up to 15 drives on each channel
- Performance monitoring with Compaq Insight Manager
- Automatic and manual performance tuning
- Pre-Failure Warranty and Pre-Failure Notification for Compaq drives

- Tagged command queuing
- Multiple logical drives and drive arrays
- 32-bit PCI Bus Master interface
- 16-MB total memory; 8-MB read-ahead cache
- Array transfer capability to the Compaq Smart Array 3200, 4200, or 5300 Controllers
- Online capacity expansion
- Logical drive extension
- RAID level migration
- Stripe-size migration
- Easy-to-use Array Configuration Utility (ACU)
- Option ROM Configuration for Arrays Utility

NOTE: If higher performance, higher availability, or higher capacity is required, arrays can be moved from the Integrated Smart Array Controller to a higher performance array controller without requiring a backup-and-restore procedure, but only if relative drive order is maintained. If relative drive order is changed, or if no data backup exists, perform a full backup before moving any array to another controller.

Controller Interface

The Integrated Smart Array Controller server interface is a Peripheral Component Interface (PCI) bus. The PCI bus is a high-performance, 32-bit bus with multiplexed address and data lines. It includes a parity signal and provides a high-speed path (up to 132 MB/s) between the system board and the array controller. The Integrated Smart Array Controller is a PCI Bus Master device and conforms to PCI Local Bus Specification, Revision 2.2.

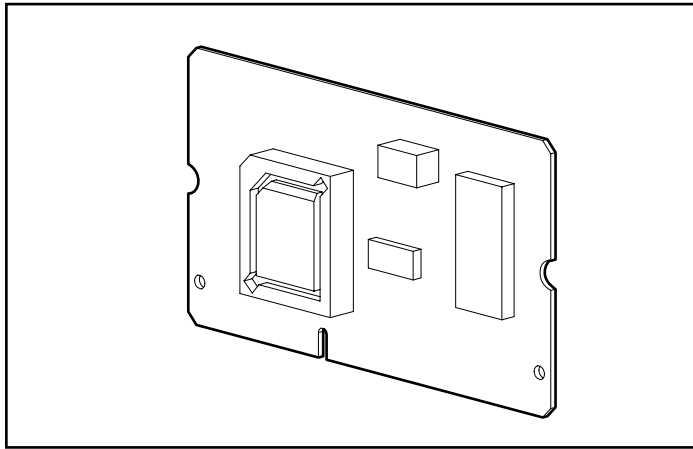


Figure 1-1. Integrated Smart Array Controller

Drive Array Technology

Drive array technology distributes data across a series of hard drives to unite *physical drives* into one or more *logical drives*. Distributing data allows concurrent access to data from multiple drives in the array, yielding faster input/output rates than nonarrayed drives. Each logical drive in the array may be set to a different fault-tolerant configuration and the Integrated Smart Array Controller manages the drive array independent of the host processor.

The Compaq Array Configuration Utility found on the SmartStart and Support Software CD guides you through configuring the hardware in the way that best suits your needs.

Refer to the material in Appendix B for general information about drive arrays. Chapter 4 contains information about configuring your Integrated Smart Array Controller with Option ROM Configuration for Arrays utility, and Chapter 6 contains information about configuring hard drives and drive arrays with the Compaq Array Configuration Utility.

Fault Tolerance

Fault tolerance relies on various methods for protecting data from loss in the event of a hardware failure somewhere in the storage system. Each method has its advantages, so choosing one requires careful planning for your particular requirements.

Fault-tolerance methods supported by the Integrated Smart Array Controller and the Compaq Array Configuration Utility include:

- Distributed data guarding (RAID 5)
- Drive mirroring (RAID 1)
- Drive striping and mirroring (RAID 0+1)
- No-fault tolerance (RAID 0)
- Further data protection achieved by assigning an online spare to any RAID 0+1, RAID 1, or RAID 5 configuration

See Appendix B for more information on fault-tolerance methods supported by the Integrated Smart Array Controller. Chapter 6, “Compaq Array Configuration Utility,” contains information on configuring your system for each of the fault-tolerance methods.

Drive Movement

An array of drives can be moved from one system to another as long as the relative order of the drives is maintained. However, when the relative order of the drives is changed, or if a new array controller is installed or reconfigured, all data stored on the drives are affected. For more information, refer to Chapter 6 in this guide.

Read-Cache Memory

The Integrated Smart Array Controller has 16 MB of total memory, with 8 MB dedicated for read-ahead cache.

Expanding and Extending Capacity

The Compaq Array Configuration Utility (ACU) makes changing your storage configuration simple, even in fault-tolerant configurations, without requiring a data backup-and-restore cycle. If you are using Microsoft Windows NT or Novell NetWare operating systems with hot-plug drives, storage expansion or extension can be performed online without shutting down the server or exiting the operating system.

The Compaq ACU supports two important utilities:

- Capacity expansion—Adding capacity and creating new drives
- Capacity extension—Enlarging existing logical drives

Online RAID Level and Stripe Size Migration

The Array Configuration Utility allows you to reconfigure a currently configured logical drive for a new fault-tolerance (RAID) level or move an existing logical drive's stripe size to a new stripe size online without disruption to system operations and without loss of data. For more information about online RAID level and stripe size migration, refer to Chapter 6.

Wide Ultra2 SCSI Technology

The Integrated Smart Array Controller uses Wide Ultra2 SCSI technology for improved performance. Wide Ultra2 SCSI technology uses Low Voltage Differential (LVD) signaling to allow maximum burst rates on the Ultra2 SCSI bus of up to 80 MB/s. LVD signaling doubles the maximum burst rates available in Wide-Ultra SCSI-3 devices.

NOTE: The maximum burst rate of up to 80 MB/s provided by Wide Ultra2 SCSI (LVD) signaling is achieved only when the array contains Wide Ultra2 SCSI (LVD) devices exclusively.

Wide Ultra2 SCSI Compatibility

The Integrated Smart Array Controller is compatible with your existing SCSI devices. Wide Ultra2 SCSI works with devices that respond at transfer rates of up to 80 MB/s. Connected peripherals are limited to response times no faster than the transfer rate of the slowest device in the array.

Wide-Ultra SCSI-3 Compatibility

In addition to using Wide Ultra2 SCSI technology, the Integrated Smart Array Controller complies with ANSI SCSI-3 standards and can support 16-bit Wide-Ultra SCSI-3 devices.

Configuration Utilities

Compaq offers a choice of tools for drive array configuration including:

- OptionROM Configuration for Arrays—a basic utility run during the POST process that allows you to configure the first array and logical drive where you will install an operating system.
- Array Configuration Utility—a full-featured utility, run from the SmartStart and Support Software CD, that allows you to configure arrays and logical drives to suit your system needs.
- Online versions of the Array Configuration Utility—advanced utilities (one each for Novell NetWare and Microsoft NT) that allow you to configure arrays and logical drives while your server is up and running.

The following general procedure explains the order and usage of utilities:

1. Backup your existing data, if any.
2. Install the Integrated Smart Array Controller.
3. Run the Option ROM Configuration for Arrays utility to configure the first array and logical drive on your server.
4. Restore data that were backed up in Step 1, if any.
5. Install your operating system.

NOTE: For detailed instructions on installing operating systems, refer to the instructions in Chapter 5.

6. Run Array Configuration Utility tools to configure and manage server storage with the Integrated Smart Array Controller.

Option ROM Configuration for Arrays Features

Use the Option ROM Configuration for Arrays utility to create your first logical drive before installing your operating system.



CAUTION: Back up all data stored on existing drives before installing the Integrated Smart Array Controller. All data stored on nonarray drives will be destroyed when the new array controller is installed.

The Option ROM Configuration for Arrays utility supports the following items:

- Up to six physical drives and one logical drive
- RAID 0, RAID 1, RAID 0+1, and RAID 5 configurations
- Online spare (hot-spare) configurations
- Functionality for configuring one logical drive that is used as the boot device, viewing the current logical drive configuration, and deleting the current logical drive configuration

Chapter 4 provides detailed instructions for using the Option ROM Configuration for Arrays utility features.

Array Configuration Utility Features

The Compaq Array Configuration Utility (ACU) is an easy-to-use, graphical configuration utility designed to help you set up and change drive array configurations.

You can run this utility by booting your server from the SmartStart and Support Software CD. Online versions of ACU for Microsoft NT and Novell NetWare do not require you to reboot the server.

Compaq ACU has the following features:

- Provides graphical views of Compaq drive array configurations
- Helps optimize array configurations with configuration wizards*
- Provides express or custom initial configurations*
- Supports RAID 0, RAID 1, RAID 0+1, and RAID 5 configurations
- Sets drive rebuild priorities
- Supports online spare (hot-spare) configurations

- Supports separate fault-tolerance configurations on an individual logical drive basis
- Supports easy capacity expansion and logical drive extension
- Supports RAID and stripe-size migration

NOTE: Items with asterisks (*) are not supported in the NetWare online version of ACU.

Chapter 6 provides detailed instructions for using ACU features.

Installing the Integrated Smart Array Controller

If you purchased the Integrated Smart Array Controller as an option for your server, you must install the controller before performing any configuration operations.

For additional information about installing hardware options in your server, refer to the user documents provided on the Documentation CD provided with your server.



CAUTION: Back up all data stored on existing drives before installing the controller. All data stored on nonarray drives will be destroyed when the new controller is installed.

IMPORTANT: Before installing the Integrated Smart Array Controller, update the firmware with the latest version, available from the Compaq website

<http://www.compaq.com>

Use the following procedure to install the controller on the system board:

1. Back up all data stored on existing drives.
2. Put the server in Standby mode by turning off power from the power switch.
3. Disconnect the power cord and all external devices.
4. Open the system access panel as indicated in your server's setup and installation guide.
5. Locate the Integrated Smart Array Controller slot on the system board. Consult your server documentation or hood label for controller location.

6. Insert the tab end of the controller into the slot at an angle ❶ as shown below.

NOTE: The controller is keyed to fit the controller slot with the notch toward the bracket wall. If the controller does not snap into place, check the direction of the notch.

7. Press down evenly on both sides of the controller ❷ until it clicks into place.

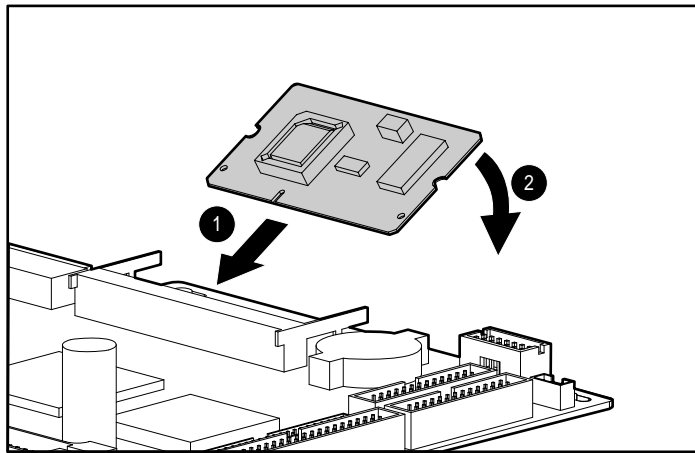


Figure 1-2. Inserting the controller into the system board

NOTE: Your system board may look different.

8. Close the server and reconnect the power cord.
9. Power on the server; let the system detect and configure the controller.



CAUTION: You are required to restore all data stored on the server after installing the optional Integrated Smart Array Controller. Any information that was not backed up before installation is permanently deleted when the system is powered on.

10. Restore any data that was backed up before controller installation.

NOTE: After the controller is installed in your server, continue to update your firmware as needed and configure the controller to manage hard drives and drive arrays.

Chapter **2**

External Cabling

This chapter provides instructions for cabling an external storage system to your server with the Integrated Smart Array Controller. The cabling guidelines provided below use Compaq storage systems. For additional cabling and setup information, refer to the documentation provided with your external storage system.

External SCSI Connectors

Use the external SCSI cables provided with the system to ensure a proper connection from the Integrated Smart Array Controller to an external storage system. Compaq Storage Systems configured with external SCSI connectors may include:

- ProLiant Storage System Model U1 (single bus)
- ProLiant Storage System Model U2 (dual bus)
- ProLiant Storage System Model UE (high-capacity single bus)
- StorageWorks Enclosure Model 4214R and 4214T (Ultra2 high density and capacity)

External Cables

Cables provided with these Compaq storage systems are equipped with external 68-pin Wide SCSI connectors requiring a 6-foot or 12-foot VHDCI-to-Wide SCSI cable, depending on the configuration for your system. In Compaq systems:

- Rack models of the U1, U2, and UE and the Models 4214R and 4214T use a 12-foot VHDCI-to-Wide SCSI cable.
- Tower models of the U1, U2, and UE use the 6-foot VHDCI-to-Wide SCSI cable.
- An optional 39-foot VHDCI-to-Wide SCSI cable is available for use with Enclosure Models 4214R and 4214T.

Cabling External Storage Systems

Preparing the Server

Prevent data loss by backing up all data stored on your server's hard drives. Press the power switch on the front panel of the server to place it in Off/Standby mode. If the server remains unopened, it is not necessary to disconnect power and peripheral cables when you install an external SCSI connection.

Consult the user documentation provided with your storage system for exact cabling instructions and warnings.

IMPORTANT: Before connecting an external SCSI device to the external SCSI connector on the rear panel of the server, disconnect all devices from the internal SCSI port of the same channel, including the terminated SCSI cable. See your server documentation for specific cabling guidelines.

Connecting SCSI Cables

Optional mass storage SCSI devices such as Compaq ProLiant Storage Systems can be connected to the server with the external SCSI connector on the back of the unit. To connect your server to an external storage device, refer to the installation documentation provided with the external storage device and your server.

Use the following general procedure to connect your server to a mass storage SCSI device:

1. Place the server in Standby mode and disconnect the AC cords.
2. Remove the access panel.
3. Disconnect all devices, including the terminated SCSI cables (if any) from the internal SCSI port that is located on the same SCSI channel as the external SCSI port. (To remove the cable, see your server installation documentation on SCSI channel configuration procedures.)
4. Replace the access panel.
5. Use the cable provided with your storage system to attach the external SCSI connector (on the rear panel of the server) to the external SCSI connector (on the rear panel of the storage system).

The illustration below shows a typical configuration for a tower-to-tower external SCSI connection to a storage system.

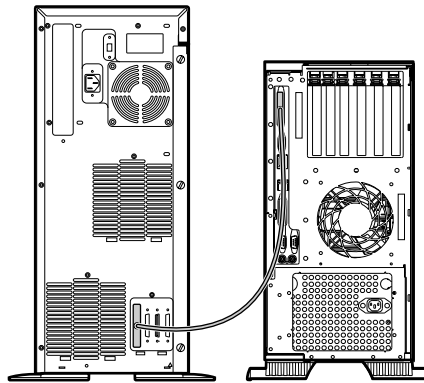


Figure 2-1. Connecting a tower model server to a tower model storage device



CAUTION: Failure to connect external drives to the correct port or controller will result in loss of data.

The external SCSI connector on the rear panel of the server is dedicated for use with external SCSI devices only, and the internal SCSI port of the same channel is dedicated for use with internal SCSI devices only. The SCSI port of the same channel cannot be used for both internal and external devices at the same time.

StorageWorks Enclosure Model 4214

External storage systems available from Compaq authorized resellers include the StorageWorks Enclosure Model 4214. The external cabling configuration for the Model 4214 is shown in the illustration below.

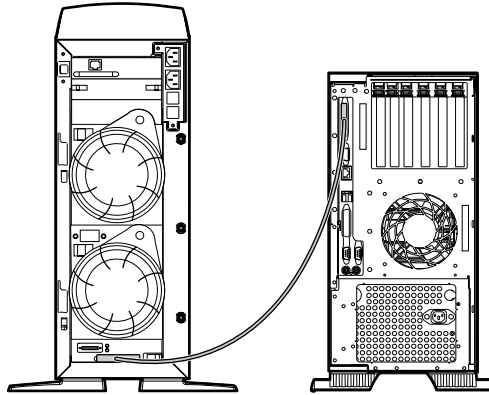


Figure 2-2. Connecting the external SCSI connector to a StorageWorks Enclosure Model 4214

Configuring the Controller

After external connections to the storage system are secure, power up the server. The system detects the installed external storage system and prompts you to configure the Integrated Smart Array Controller for additional physical drives. Refer to Chapter 4, “Option ROM Configuration for Arrays Utility,” for detailed instructions on configuring the Integrated Smart Array Controller.

Updating Firmware

The ROMs on all Compaq servers and most Compaq options can be updated easily by *flashing* the ROM. To flash a ROM, Compaq ROMPaq replaces the existing contents of the ROM with an updated version stored in a disk file. This method is a convenient way to distribute new firmware and to keep Compaq products up-to-date with the latest capabilities.

There are two ROMPaq utilities:

- System ROMPaq

Update the system ROM in all Compaq servers supporting Flash ROM. Use System ROMPaq when you install a new Integrated Smart Array Controller in a Compaq server to be sure that the server utilizes the full range of capabilities available from the Integrated Smart Array Controller.

- Options ROMPaq

Update the onboard ROM on all Compaq options supporting Flash ROM. Use Option ROMPaq when new versions of the Integrated Smart Array Controller firmware or SCSI drive firmware become available to take advantage of expanded capabilities.

IMPORTANT: Before you install the new Integrated Smart Array Controller in your server, update the system firmware by running the System ROMPaq utility. This process ensures that you have the latest ROM on your system.

Use the instructions in the following section to create diskettes with the latest version of System ROMPaq from the Compaq SmartStart and Support Software CD.

ROMPaq Diskettes

The latest version of ROMPaq is stored on the SmartStart and Support Software CD and should be used to create the diskettes for ROMPaq utilities to support the Integrated Smart Array Controller.

The latest ROMPaqs may also be downloaded from the Compaq website:

<http://www.compaq.com>

At the website, locate your software in the Support area.

Materials Needed

Use the following items to create ROMPaq utility diskettes:

- Compaq SmartStart and Support Software CD
- 3 to 5 blank diskettes for System ROMPaq or 10 to 15 blank diskettes for Options ROMPaq
- Access to a server or workstation with a bootable CD-ROM drive or any system running in a Microsoft Windows-based environment that has an installed CD-ROM drive. This may be the system in which you are installing the Integrated Smart Array Controller.

Creating Diskettes

Use the following procedure to create ROMPaq diskettes:

1. Open SmartStart either of the following ways:
 - Boot the server from the Compaq SmartStart and Support Software CD. In Windows, the Diskette Builder utility loads automatically.
 - Run Diskette Builder from any Windows-based PC.

NOTE: It is not necessary to perform a SmartStart installation. Select Diskette Builder and disregard any screen prompts to perform a full installation.

2. From the Compaq Diskette Builder screen, select Create Software Diskettes from CD Only.

3. From the Diskette Builder screen, scroll through the list and select one of the following ROMPaq options:

NOTE: Click on the small + symbol to open the Compaq folder.

- ☐ System ROMPaq Firmware Upgrade Diskette for your server
 - ☐ Options ROMPaq
4. Once you have chosen the diskette set you want to create, select the Next button in the lower right-hand corner of your screen.
 5. Follow the instructions displayed on the screen to create ROMPaq diskettes.

Running System ROMPaq

System ROMPaq is a utility that updates the firmware in Compaq servers including the enhanced drive array capabilities available from the Integrated Smart Array Controller. To update all devices and maximize the capabilities of the controller, Compaq recommends that you run the latest System ROMPaq when installing or upgrading your new Integrated Smart Array Controller. The latest ROMPaq can also be downloaded from the Compaq website:

<http://www.compaq.com>

At the website, locate your software in the Support area.

If you purchased your server with the Integrated Smart Array Controller already installed, you do not need to run System ROMPaq at the time of server installation.



CAUTION: If you are upgrading from an existing Integrated Dual Channel Wide Ultra2 SCSI Controller to the Integrated Smart Array Controller, you must back up all data stored on hard drives before you make the upgrade. Installing the Integrated Smart Array Controller destroys all stored data on existing drives.

Run System ROMPaq:

1. Use the power switch on the front of the server to turn off power and place the system in Standby mode.
2. Place the System ROMPaq diskette that you created from the Compaq SmartStart and Support Software CD in the server diskette drive.
3. Start the server from the power switch on the front of the server.
4. Press **Enter** at the Welcome screen.

5. At the Select A Device screen, select the server from the list of the programmable devices. There may be only one item in the list.

6. Press **Enter**.

7. At the Select An Image screen, the following is displayed:

Device to reprogram:	your server
Current ROM revision:	date of existing ROM version
Select Firmware Images:	date of latest ROM version

8. Press **Enter**.

9. Review the information on the Caution screen:

Device to reprogram:	your server
Current ROM revision:	date of existing ROM version
Selected ROM revision:	date of ROM version to be installed

10. Perform one of the following steps:

- ☐ Press **Esc** to discontinue reprogramming and return to the Select An Image screen.

OR

- ☐ Press **Enter** to reprogram the system ROM.

The message “Reprogramming Firmware” indicates that the system ROM is being reprogrammed.



CAUTION: Do not interrupt this cycle. Interrupting the ROM reprogramming leaves the firmware in an unknown state and you may not be able to boot the server. You will be notified when reprogramming is completed.

11. When ROMPaq is finished reprogramming the system ROM, press **Esc** to exit the System ROMPaq Utility.

12. Remove the System ROMPaq diskette and restart the server by cycling the power or by performing a cold start.

After ROMPaq has updated all of your firmware, install the Integrated Smart Array Controller in the array controller slot on your server board. Refer to Chapter 1 and your server documentation for detailed instructions on installing the Integrated Smart Array Controller.

Running Options ROMPaq

Options ROMPaq is used to update the firmware on Compaq options including Integrated Smart Array Controller. Use this utility to update the controller and drives whenever updated versions become available. Because it is difficult to determine when to update the firmware, keep current with the latest revisions through the Compaq website:

<http://www.compaq.com>

At the website, click Support and navigate the options for software.

The Integrated Smart Array Controller firmware version included on the Compaq SmartStart and Support Software CD has already been installed on the controller, so you do not need to update it immediately. However, if you use an older array controller or other Compaq options, you may want to create the Options ROMPaq diskettes to ensure that your firmware is up-to-date.

Use the following procedure to run Options ROMPaq:

1. If the server is on, power down the server.
2. Place the Options ROMPaq diskette 1 into the server diskette drive.
3. Start the server by turning on the power from the power switch on the front of the server.
4. Press **Enter** at the Welcome screen.
5. At the Select A Device screen, select Compaq Integrated Smart Array Controller from the list of programmable devices.
6. Press **Enter**.
7. If the ROM firmware for the Integrated Smart Array Controller is older than the firmware on the Options ROMPaq diskette, the Select An Image screen displays:

Device to reprogram:	COMPAQ Integrated Smart Array Controller
Current ROM revision:	COMPAQ Integrated Smart Array Controller x.xx
Select Firmware Images:	COMPAQ Integrated Smart Array Controller y.yy
8. Press **Enter**.

NOTE: If the ROM firmware for the Integrated Smart Array Controller is the same or newer than the firmware on the Options ROMPaq diskette, you see the following message: "The ROM image files found for the device selected are not older than the current ROM image."

Press **Enter** to accept and proceed to Step 9.

9. Review the information on the Caution screen:

Device to reprogram:	COMPAQ Integrated Smart Array Controller
Current ROM revision:	COMPAQ Integrated Smart Array Controller x.xx
Selected ROM revision:	COMPAQ Integrated Smart Array Controller y.yy

10. Perform one of the following steps:

- ☐ Press **Esc** to discontinue the reprogramming and return to the Select An Image screen.

OR

- ☐ Press **Enter** to reprogram the Integrated Smart Array Controller ROM. The following onscreen message indicates that the Integrated Smart Array Controller ROM is being reprogrammed.



CAUTION: Do not interrupt the reprogramming cycle. Interrupting the ROM reprogramming will leave the firmware in an unknown state. If this happens, you may not be able to reprogram the ROM, and the Integrated Smart Array Controller ROM may have to be replaced. You will be notified when reprogramming is completed.

11. When the Options ROMPaq has finished reprogramming the Integrated Smart Array Controller ROM, do one of the following:

- ☐ Press **Enter** to reprogram another Compaq option, and repeat steps 5 through 10.

OR

- ☐ Press **Esc** to exit the ROMPaq Utility.

12. After exiting the ROMPaq Utility, remove the Options ROMPaq diskette and restart the server by cycling the power or performing a cold start.

The Integrated Smart Array Controller ROM is now reprogrammed and allows you to take advantage of new or increased capabilities available with the new firmware.

Chapter 4

Option ROM Configuration for Arrays Utility

After installing the Integrated Smart Array Controller, you must configure the controller before configuring the first array and logical drive. The Option ROM Configuration for Arrays utility supports only controllers that require a single-boot device.

Requirements

The Option ROM Configuration for Arrays utility streamlines the controller software's complex functions and its interaction with other configuration utilities. The utility limits operation to the following functions:

- The software configures only one logical drive that is used as the boot device. Additional logical drives can be configured with the online Array Configuration Utility (ACU) or with the ACU version provided on the SmartStart and Support Software CD.

NOTE: Novell NetWare and Windows NT operating systems are supported by the online Array Configuration Utility. Other operating systems, including IBM OS/2, SCO OpenServer, Banyan VINES, and others, can be run from the Compaq SmartStart and Support Software CD. Chapter 6 explains how to run the ACU for various operating systems.

- The software supports functionality for configuring a single logical drive, viewing the current logical drive configuration, and deleting the current logical drive configuration.

- The software runs only when six or fewer physical drives (total) are attached to the supported SCSI buses **and** only one logical drive is configured.
- The software is available in an English language version only.
- The software does not support any input devices, such as the mouse or trackball.

Initial Start Screen

The Initial Start screen appears when:

- Not more than one logical drive is configured
- No more than six physical drives are attached to all of the supported SCSI buses

The screen text is appended to any current display on the video adapter, and it will not erase any previous Power-On Self-Test (POST) or boot information. The message has a 15-second timer when no logical drives are configured, and it has a 5-second timer when a logical drive is configured. When the timed message expires, the utility is skipped.

<pre>Compaq Integrated Smart Array Controller (ver x.xx) Press <F10> to run the Option ROM Configuration for Arrays utility Press <Esc> to skip configuration and continue</pre>
--

Figure 4-1. Initial Start screen

NOTE: The version number displayed in the Initial Start screen you see reflects the actual version available on your machine.

Create Logical Drive Screen

The Create Logical Drive screen allows you to select the new configuration. This screen appears when no logical drives are configured. The number of available physical drives is shown in the menu box.

Option ROM Configuration for Arrays, version x.x
Copyright 1999, COMPAQ Computer Corporation

Integrated Smart Array Controller

Detected Physical Drives

SCSI Port 2: ID 00, COMPAQ AB00911790	4.3GB Drive
SCSI Port 2: ID 01, COMPAQ AB00911790	4.3GB Drive
SCSI Port 2: ID 02, COMPAQ AB00911790	4.3GB Drive
SCSI Port 2: ID 03, COMPAQ AB00411792	4.3GB Drive

Please select the logical drive configuration

<input type="checkbox"/>	12.9GB RAID 5 drive, parity, fault tolerant, no online spare
<input checked="" type="checkbox"/>	8.6GB RAID 5 drive, parity, fault tolerant, with online spare
<input type="checkbox"/>	8.6GB RAID 1 drive, mirrored, fault tolerant, no online spare
<input type="checkbox"/>	4.3GB RAID 1 drive, mirrored, fault tolerant, with online spare
<input type="checkbox"/>	17.2GB RAID 0 drive, no fault tolerance

Press the arrow keys to select an item

Press <F10> to accept the selection and continue

Press <Esc> to cancel and return to the previous screen

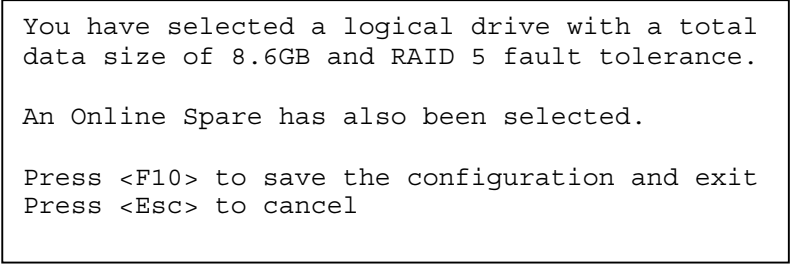
Figure 4-2. Create Logical Drive screen

IMPORTANT: If the logical drive configuration selection you need is not shown on the Create Logical Drive screen, you must run the Array Configuration Utility (ACU) for your operating system as described in Chapter 6.

NOTE: The logical drive configuration choices shown on your Create Logical Drive screen reflect the actual drives available on your system.

Confirmation Screen

After you select a logical-drive configuration, the Confirmation screen appears as a pop-up panel on top of the screen.

A rectangular box with a thin black border containing text in a monospaced font. The text is centered and reads: "You have selected a logical drive with a total data size of 8.6GB and RAID 5 fault tolerance." followed by "An Online Spare has also been selected." followed by "Press <F10> to save the configuration and exit" followed by "Press <Esc> to cancel".

You have selected a logical drive with a total
data size of 8.6GB and RAID 5 fault tolerance.

An Online Spare has also been selected.

Press <F10> to save the configuration and exit
Press <Esc> to cancel

Figure 4-3. Create logical drive confirmation screen

Pressing **F10** saves your logical drive selection for the Integrated Smart Array Controller and continues with the operating system installation.

View/Delete Logical Drive Screen

The View/Delete Logical Drive screen allows you to delete the logical drive. This screen appears when only one logical drive is configured.

```
Option ROM Configuration for Arrays, version x.x
Copyright 1999, COMPAQ Computer Corporation

Compaq Integrated Smart Array Controller

Detected Logical Drive Configuration
  8.6GB RAID 5 drive, fault tolerant with online spare

Physical Drives Assigned
  SCSI Port 2: ID 00, COMPAQ AB00911790      4.3GB Drive
  SCSI Port 2: ID 01, COMPAQ AB00911790      4.3GB Drive
  SCSI Port 2: ID 02, COMPAQ AB00911790      4.3GB Drive

Online Spare
  SCSI Port 2: ID 03, COMPAQ AB00411792      4.3GB Drive

Press <F3> to delete the logical drive configuration
Press <Esc> to exit
```

Figure 4-4. View/Delete Logical Drive screen

NOTE: The logical drive configuration shown on your View/Delete Logical Drive screen reflects the actual drives that are available on your system.

Pressing **F3** deletes all settings, exits the Option ROM Configuration for Arrays utility, and continues the POST and reboot process. To reconfigure the Integrated Smart Array Controller, start the Option ROM process from the beginning or initiate the Array Configuration Utility according to the instructions for your operating system listed in Chapter 6 of this guide.

Confirmation Screen

After you select a logical drive to delete, another confirmation screen appears as a pop-up panel on top of the screen.

You have selected to delete the configured logical drive. This will result in complete data loss for this logical drive.

Press <F3> to delete the logical drive
Press <Esc> to cancel

Figure 4-5. View/Delete Logical Drive confirmation screen

Installing the Operating System Drivers

This chapter outlines the driver installation steps to set up the Integrated Smart Array Controller in an existing server running the following operating systems:

- Novell NetWare 3.2, 4.2, and 5.0
- Microsoft Windows NT 4.0 and Windows 2000
- Linux
- SCO OpenServer 5.0.4 and 5.0.5
- SCO UnixWare 2.X and 7.X
- IBM OS/2 Warp Server Family
- Banyan VINES 7.X and later versions

If you are setting up a new system, use the SmartStart and Support Software CD supplied with the server to install both the operating system and the required drivers for the Integrated Smart Array Controller.

If you install the operating system software from the SmartStart and Support Software CD, all of the software, including device drivers, is automatically installed and configured for the Integrated Smart Array Controller. Drivers and configuration information for the Integrated Smart Array Controller are provided on the SmartStart and Support Software CD. Refer to the documentation provided with your server for installation instructions.

Before Installing Drivers

Before installing the drivers, you should have:

- Updated your system firmware by running System ROMPaq
- Installed the Integrated Smart Array Controller
- Configured the hardware by running the System Configuration Utility
- Used an array configuration utility to configure at least one drive array

Materials Needed

If you did not use SmartStart to install your operating system, assemble the following materials before installing controller drivers:

- Compaq SmartStart and Support Software CD
- Blank diskettes
- Any server or workstation with a bootable CD-ROM drive or any workstation running Windows 95, 98, or NT with an available CD-ROM drive

Creating Installation Diskettes

Some operating systems, including IBM OS/2, SCO OpenServer, UnixWare, Banyan VINES, and others, are not supported by the online Array Configuration Utility (ACU). These systems require you to create installation disks before using the configuration utilities stored on the SmartStart and Support Software CD.

Use the instructions in the following sections to create the installation disks for your operating system. Although Novell NetWare and Microsoft Windows NT systems are supported by online ACU, instructions for setting up install disks are provided below as an option. For additional information about loading drivers with your operating system, refer to the documentation provided by the manufacturer.

Creating Installation Diskettes for Common Operating Systems

Use the following general procedure to create installation diskettes with drivers for the following operating systems:

- Novell NetWare (driver *CPQARRAY.HAM*, version 2.05 or later)
- Microsoft Windows NT and Windows 2000
- Linux
- SCO OpenServer 5 and UnixWare
- IBM OS/2

NOTE: If you are using the Banyan VINES operating system, proceed to the next section to create installation diskettes.

To install the driver, create the diskettes for your operating system. These diskettes contain the latest drivers and documentation for using Compaq equipment in your operating system's environment.

Create the diskettes:

1. Run the SmartStart and Support Software CD in one of the following ways:
 - ☐ From a local CD-ROM on a workstation running Windows 95/98

NOTE: If the AutoRun function is enabled, the CD will start automatically. If AutoRun is not enabled, browse to or type in the name of the program file on your CD-ROM drive.

- ☐ By booting the server from the CD-ROM
2. At the Compaq System Utilities screen, select the option to create support software.
3. At the Diskette Builder screen, select the option to create support software diskettes from the CD only.
4. Scroll through the list and select the appropriate operating system.
5. Follow the instructions for creating and labeling the diskettes.

NOTE: For Linux users, specific information pertaining to your distribution will be present in a README file on the Linux support diskette.

Creating Banyan VINES Peripheral Adapter Support (PAS) Diskettes

The Banyan VINES, version 7.0 or later, driver for the Integrated Smart Array Controller is located on the Compaq SmartStart and Support Software CD. To install the driver, create the Compaq installation for Banyan VINES diskettes. These diskettes contain the latest drivers and documentation for using Compaq equipment in a Banyan VINES environment.

If you do not have the SmartStart CD, create the installation diskettes by downloading files from the SoftPaq technical assistance area on the Compaq website:

<http://www.compaq.com>

At the website, locate your software in the Support area.

Creating Banyan VINES PAS Diskettes from the SmartStart and Support Software CD

Create the PAS diskettes from the SmartStart CD:

Create the diskettes:

1. Run the SmartStart and Support Software CD in one of the following ways.

☐ From a local CD-ROM on a workstation running Windows 95/98

NOTE: If the AutoRun function is enabled, the CD will start automatically. If AutoRun is not enabled, browse to or type in the name of the program file on your CD-ROM drive.

☐ By booting the server from the CD-ROM

2. Select Create Support Software from the Compaq System Utilities screen.
3. Select Create Support Software Diskettes from CD Only from the Diskette Builder screen.
4. Scroll down the list and select Peripheral Adapter Support Software for VINES 7.0.
5. Follow the instructions on the screen to create the diskettes.

Creating Banyan VINES PAS Diskettes from SoftPaq

If you do not have access to the Compaq SmartStart and Support Software CD, create Banyan VINES installation diskettes as follows:

1. Obtain two formatted 1.44-MB diskettes.
2. Locate and download the SoftPaq file called *SPXXX.EXE* to your hard drive.
3. Run the downloaded file from your hard drive by typing the following:

```
C:\DIR\SPXXX.exe
```

where C:\dir\ is the directory path on your hard drive. Executing this file places several new files on your machine, including the program file *QRST5.EXE*.

4. Run the *QRST5.EXE* file and follow the on-screen instructions to insert DOS-formatted diskettes for creating the SSD diskettes.
5. After the SSD diskettes are created, delete any downloaded file from SoftPaq.
6. Insert the documentation diskette (diskette 2) into the diskette drive and view the installation instructions in either of two ways:

- ☐ Type the file path and name from the DOS prompt:

```
A:\README
```

- ☐ Boot the system with the documentation diskette in the diskette drive.

NOTE: New SoftPaqs are available on the Compaq website

<http://www.compaq.com>

Novell NetWare

Use the instructions in this section to install the driver for the new Integrated Smart Array Controller or to upgrade the driver in an existing Novell NetWare server. If you did not use SmartStart to install the NetWare operating system and drivers, create the Novell SSD diskettes as described in the section in this chapter called “Creating Installation Diskettes for Common Operating Systems.”

Latest Information

Readme files containing the latest information about using Compaq options in a NetWare environment, including the driver installation procedure, are included on the Novell SSD diskettes. Locate the Readme files to familiarize yourself with this procedure. If the procedure differs from the one described below, use the procedure on the SSD diskette.

To read the Readme files, you need a server with a DOS partition or a workstation running a current version of MS-DOS or Microsoft Windows 95/98/NT:

1. Place the Novell SSD diskette in the floppy drive.
2. From the DOS prompt, type:

A:\README

or

Select Start → Run from Windows, then enter:

A:\README.COM

3. Select the files to read or print. Some files that should be of particular importance:
 - ☐ *READIST.RDM*
 - ☐ *DRIVERS.RDM*
 - ☐ *STORAGE.RDM*

Installation Procedure

The following steps outline the procedure to install the Integrated Smart Array Controller driver for Novell NetWare on your server.

1. If the server is not running, start the server from the boot hard drive.
2. Insert the Novell SSD diskette three created from SmartStart into the diskette drive.
3. Copy *CPQARRAY.HAM*, *CPQARRAY.DDI*, and *CPQSHD.CDM* from the Novell SSD diskette to C:\NWSERVER.

NOTE: The boot hard drive containing the primary DOS partition is usually the C drive. If your primary DOS partition is located on a different drive, type the letter for that drive in place of the letter C in the example above.

4. Edit the *STARTUP.NCF* file so that the driver is loaded automatically at system startup.
5. Reboot the server.
6. Refer to your NetWare installation documentation for information about installing and mounting volumes associated with your new disk subsystem.

Compaq Online Array Configuration Utility for NetWare (CPQONLIN)

The Compaq Online Array Configuration Utility for NetWare, *CPQONLIN.NLM*, version 2.30A or later, is an NLM that allows you to configure your drive arrays without shutting down your NetWare server. The *CPQONLIN.NLM* is located on diskette 4 in the \ONLINE directory of the Novell SSD diskettes you created from the SmartStart CD. Load the NLM and follow the instructions on the screen to use this online utility to configure your drive arrays.

The Compaq Online Array Configuration for NetWare utility cannot be used until after the driver, *CPQARRAY.HAM*, is installed, either with the latest version of SmartStart or manually as described in this chapter.

Chapter 6 provides detailed instructions about running the Compaq Online Array Configuration Utility.

Optimizing Array Controller Performance

To increase the performance of your disk subsystems under Novell NetWare versions 3.2, 4.2, and 5.0, perform the following steps before installing NetWare volumes or partitions:

- If you selected a fault-tolerance option, such as mirroring or distributed data guarding when using the Compaq System Configuration Utility, do not select mirroring while using NetWare *INSTALL.NLM*. The fault-tolerance capabilities of the Integrated Smart Array Controller provide performance improvements and automatic data recovery features.
- Novell recommends that you create volumes with a 64-kb block size and that you use the Block Sub-Allocation feature of Novell NetWare. Using a large block size decreases the amount of RAM required to mount the volume, while Block Sub-Allocation allows NetWare to allocate disk space more efficiently.
- Linear memory configuration provides the best performance in a Novell NetWare environment. When you use the Compaq System Configuration Utility to configure your server with NetWare, the memory options default to linear memory. To verify the setting, run the Compaq System Configuration Utility and view the Compaq Memory settings. Make sure that the linear option is selected under the Base Memory option.

Microsoft Windows NT 4.0

This section includes instructions for installing the initial driver for a first-time Integrated Smart Array Controller installation or for upgrading the driver for an installed Smart Array Controller in an existing Windows NT server.

If you used SmartStart to install Windows NT and drivers on a new server, you do not need to make the Support Server Diskette (SSD) utility diskettes and can continue with the procedure below. Before proceeding, if you did not use SmartStart to install Windows NT, create the installation diskettes as described earlier in this chapter in the section called “Creating Installation Diskettes for Common Operating Systems.”

Materials Needed

To install the Integrated Smart Array Controller Windows NT driver on your server, you will need:

- Compaq SmartStart and Support Software CD
- Access to a server or workstation with a bootable CD-ROM drive or any system running Windows 95, 98, or NT with an available CD-ROM drive
- Compaq SSD for Windows NT installation diskettes, if required
- Your Microsoft operating system CD or media

Additional Information

A file called *NTREADME.HLP* on the Compaq SSD for Windows NT diskettes contains the latest information about Windows NT, including the driver installation procedure. Review this information and, where different from the instructions shown here, use the instructions provided in *NTREADME.HLP* file.

To read the *NTREADME.HLP* file, you need a server running Microsoft Windows NT or a workstation running Windows. Perform the following steps:

1. Insert the Compaq SSD for Windows NT diskettes, beginning with diskette 1, into the diskette drive.
2. At a command prompt, make A: the current drive and type:

README.BAT

or

From the File pull-down menu in Windows Program Manager, select Run and type:

A:\README.BAT

3. Select help topics to read or print. Important help topics include:

- ☐ Compaq SSD for Windows NT installation methods
- ☐ Using the Compaq SSD for Windows NT Setup program
- ☐ Windows NT device driver specifics
- ☐ Compaq SCSI controller support
- ☐ Compaq drive array support
- ☐ Installing the Compaq drive array driver during Windows NT installation
- ☐ Installing the Compaq drive array driver after Windows NT installation
- ☐ Updating the Compaq drive array driver
- ☐ Removing the Compaq drive array driver

General Installation Procedures

Sources for installing device drivers on a Windows NT server include:

- Compaq SSD for Windows NT Setup program installation
- Standard Windows NT device driver installation during initial installation of the Windows NT operating system

If you are installing the driver after installing Windows NT, use the Compaq SSD for Windows NT installation method. If you install the driver during the initial Windows NT installation, you must use the standard Windows NT device driver installation method. Both methods are outlined in this chapter.

Installing the Integrated Smart Array Controller Driver During Windows Installation

This section describes how to install the Smart Array driver during the initial installation of the Windows NT 4.0 operating system. The driver can be installed from files on the Compaq SSD for Windows NT diskettes. Instructions for creating these diskettes are provided earlier in this chapter in “Creating Installation Diskettes for Common Operating Systems.” For instructions on installing the driver after Windows NT has been installed, see the section titled “Installing the Integrated Smart Array Controller Driver After Windows Installation” later in this chapter.

Initial Windows NT 4.0 Installation

1. Begin the Windows NT 4.0 installation process.
2. Setup automatically detects mass storage devices. When prompted to specify additional mass storage devices, press **S**.
3. From the displayed list, highlight “Other (Requires disk provided by manufacturer)” and press **Enter**.
4. As prompted, insert the Compaq SSD for Windows NT 4.0 diskette 1 and press **Enter**.
5. Select Compaq Integrated Smart Array Controller for Windows NT 4.0 from the list of displayed controllers and press **Enter**.
6. Press **Enter** and continue installation of windows NT 4.0.
7. Reinsert the Compaq SSD for Windows NT 4.0 diskette when prompted. Setup copies the drivers to the system.

Updating the Integrated Smart Array Controller Driver

Updating the Integrated Smart Array Controller driver is usually a two-step process in which you remove the driver and then re-add the driver. When you update with the new Compaq SSD for Windows NT setup program, you can skip the remove-and-add steps and proceed as follows:

1. Start Windows NT and log in to an account with administrative privileges.
2. Insert Compaq SSD diskette 1 into the diskette drive.
3. Start the Setup utility by typing the file name in the Start, Run area:

A:\SETUP

NOTE: For the command line, the letter A denotes the diskette drive. The letter for the diskette drive on your server may be different.

4. Select Custom Setup.
5. Select the Integrated Smart Array Controller as your device.
6. Click Update.
7. The setup program updates the driver on your system from the Compaq SSD diskettes.
8. Select Close to exit the setup program or select other components to install, update, or remove drivers.
9. Remove the Compaq SSD diskette.
10. Shut down Windows NT and restart the system to load the driver.

Installing the Integrated Smart Array Controller Driver After Windows Installation

Device drivers are located on the Compaq SSD for Windows NT diskettes and are installed from the Windows Setup utility. Setup identifies hardware components that are physically installed on the system and recommends device drivers that you should install or update.

Existing Windows NT 4.0 Installation

Install the Integrated Smart Array Controller through the Windows Setup utility:

1. Start Windows NT on the system and logon to an account with administrative privileges.
2. Insert the Compaq SSD for Windows NT diskette 1 into the diskette drive.
3. From the Program Manager, select File, then Run.
4. Type in the file name:

A:\SETUP

NOTE: For the command line, A: denotes letter for a diskette drive. The letter for the diskette drive on your server may be different.

5. Select Custom.

6. Select the Compaq Integrated Smart Array Controller component. If you have previously installed this driver on your system, Setup prompts you to update the driver.
 - a. Select Install.
 - b. Insert the SSD diskettes as needed.
 - c. When the driver is updated, exit and return to the Setup menu.
7. Install other components through Setup, or select Close to exit.
8. Restart the system with the diskette in the diskette drive to load the newly installed or updated driver.

Removing the Integrated Smart Array Controller Driver

Compaq drivers can be removed only with utilities available in the Windows Control Panel.

IMPORTANT: Do not remove the driver if the system is booting from a device attached to the Integrated Smart Array Controller. You will get a dialog box stating that the selected controller is marked as a boot device. Removing the driver in this case may cause the system to fail at start.

1. Start Windows NT and log in to an account with administrative privileges.
2. From the Control Panel, launch the SCSI Adapter Utility.
3. Select the Drivers tab.
4. Select Compaq Integrated Smart Array Controller and click Remove.
5. After the driver is removed, select OK. You must restart the server for the removal to take effect.

Microsoft Windows 2000

This section provides instructions for retrieving the latest files and information necessary to install the initial driver for a new Integrated Smart Array Controller or to upgrade the driver in an existing Microsoft Windows 2000 environment with an installed integrated array controller. Consult your software user documentation for additional Windows 2000 installation guidelines.

Locating the Driver and Installation Information

When you use SmartStart to install Windows 2000 and device drivers on a new server, you do not need to create the Compaq SSD for Windows 2000 installation diskettes and can continue with the procedure below. If you did not use SmartStart to install Windows 2000, use the procedure described in “Creating Installation Diskettes for Common Operating Systems” to create the installation diskettes before proceeding.

Installing the Driver

When prompted, use the Compaq SSD for Windows NT installation diskettes to install the controller driver for Windows 2000:

1. Begin the Windows 2000 installation process as described in the operating system documentation.
2. Press **F6** to load media devices and drivers.
3. Press **S** when prompted to specify additional mass storage devices.
4. Insert the Compaq SSD for Windows 2000 diskette 1 into the floppy drive and press **Enter**.
5. Select Compaq Integrated Smart Array Controller for Windows 2000 from the list of displayed controllers and press **Enter**.
6. Press **Enter** to continue installing Windows 2000.
7. Insert additional Windows NT installation diskettes as needed to complete device setup.
8. When setup for media devices is complete, press **Enter** to continue installing Windows 2000.

Linux

Consult your software user documentation for additional Linux installation guidelines.

Locating the Driver and Installation Information

This section provides instructions for retrieving the latest files and information to do the following:

- Install the initial driver for a new Integrated Smart Array Controller
- Upgrade the driver in an existing Linux environment with a newly installed Integrated Smart Array Controller

SmartStart

The latest drivers, support files, and driver installation instructions for Linux are located on the Compaq SmartStart and Support Software CD supplied with your server or options kit. To install these files, create a set of Compaq Linux Support diskettes from the Compaq SmartStart and Support Software CD. Refer to the section “Creating Installation Diskettes for Common Operating Systems” earlier in this chapter for additional information.

The Internet

The latest drivers, sources, support files, and driver installation instructions for Linux are also located on Compaq’s FTP server. Linux support diskettes for several distributions are also available on the FTP server

`ftp://ftp.compaq.com/pub/linux`

The Linux Smart Array driver is also present in Linux kernels 2.2.11 and newer, available on the Internet

`http://www.kernel.org`

Installing the Driver

Driver installation procedures vary between Linux distributions. For specific instructions about your distribution, read the README file on the support diskette.

Locating Additional Information

Additional information about installing, using, and tuning Linux on Compaq products can be found on Compaq's ActiveAnswers website:

<http://www.compaq.com/activeanswers>

SCO OpenServer 5

This section does not contain the information for setting up the Integrated Smart Array Controller in a server running SCO OpenServer 5, but it outlines the procedure to get the required information. If your system has an older SCO operating system or if you are setting up a new system with SCO OpenServer 5, you are encouraged to use SmartStart to upgrade your operating system. SmartStart is supplied with the server or may be obtained from your local Compaq authorized reseller or Compaq authorized service provider.

Consult your software user documentation for additional OpenServer installation guidelines.

Locating the Driver and Installation Information

This section provides instructions for retrieving the latest files and information necessary to install the initial driver for a new Integrated Smart Array Controller or to upgrade the driver in an existing SCO OpenServer 5 environment with an installed integrated array controller. If you use SmartStart to install the SCO OpenServer 5 operating system and drivers on a new server, or to upgrade an existing server, you do not need to create the Extended Feature Supplement (EFS) diskettes.

The latest drivers and support files for SCO OpenServer 5, as well as information about installing the driver, are located on the Compaq SmartStart and Support Software CD supplied with your server or options kit. To install these files, create a set of Compaq EFS for OpenServer 5 installation diskettes from the Compaq SmartStart and Support Software CD. Refer to the section “Creating Installation Diskettes for Common Operating Systems” earlier in this chapter for additional information.

Installing the Driver

Driver installation procedures for Compaq SCO OpenServer 5 and SCO OpenServer 5 (non-Compaq) are different. Choose the appropriate procedure for your operating system.

Compaq SCO OpenServer 5

To access the driver installation information for systems running Compaq SCO OpenServer 5:

1. Place the diskette labeled SCO Installation Notes for Compaq Servers into the diskette drive of a server or workstation capable of reading a DOS text file.
2. Use a text editor or other DOS utility to read the *INSTALL.TXT* file on the diskette.
3. Follow the instructions in this file to install the Integrated Smart Array Controller driver in a server running in an existing Compaq SCO OpenServer 5 environment.
4. Proceed to the last section in this chapter, "Updating the Compaq Insight Management Agents."

SCO OpenServer 5 (Non-Compaq)

To access the driver installation information for systems running SCO OpenServer 5 (non-Compaq):

1. Place the diskette labeled Documentation Diskette into the diskette drive of a server or workstation capable of reading a DOS text file.
2. Shut down and restart the system.
3. Locate the file named *INSTALL.TXT*, and press **Enter** to view the file, or press **F7** to print the file.

NOTE: To print the file, the server you are configuring must be connected to a printer.

4. Follow the instructions in the file to install the Integrated Smart Array Controller driver in a server running non-Compaq version of SCO OpenServer 5.
5. Proceed to the last section in this chapter, "Updating the Compaq Insight Management Agents."

SCO UnixWare 2.1 or Later

Locating the Driver and Installation Information

This section provides instructions for retrieving the latest files and information necessary to install the initial driver for a new Integrated Smart Array Controller or to upgrade the driver in an existing SCO UnixWare environment with an installed integrated array controller. If you use SmartStart to install the SCO UnixWare operating system and drivers on a new server, or to upgrade an existing server, you do not need to create the Extended Feature Supplement (EFS) diskettes. Consult your software user documentation for additional UnixWare installation guidelines.

The latest drivers and support files for SCO UnixWare as well as information about installing the driver are located on the Compaq SmartStart and Support Software CD supplied with your server or option kit. To install these files, create a set of Compaq EFS for SCO UnixWare diskettes from the Compaq SmartStart and Support Software CD. Refer to the section “Creating Installation Diskettes for Common Operating Systems” for additional information.

Installing the Driver

Install the Integrated Smart Array Controller driver:

1. Place the diskette labeled Documentation Diskette into the diskette drive of a server or workstation.
2. Reboot the system.
3. Select the file named *README.HBA* to view or print.

NOTE: To print the file, the server you are configuring must be connected to a printer.

4. Follow the instructions in this file to install the Integrated Smart Array Controller driver in server running the SCO UnixWare operating system, version 2.1 or later.
5. Proceed to the last section in this chapter, “Updating the Compaq Insight Management Agents.”

IBM OS/2

Locating the Driver and Installation Information

This section provides instructions for retrieving the latest files and information necessary to install the initial driver for a new Integrated Smart Array Controller or to upgrade the driver in an existing IBM OS/2 environment with an installed integrated array controller. If you use SmartStart to install the OS/2 operating system and drivers on a new server, or to upgrade an existing server, you do not need to create the Compaq SSD for IBM OS/2 installation diskettes. Consult your software user documentation for additional OS/2 installation guidelines.

Text, or Readme, files containing the latest Compaq information for the IBM OS/2 operating systems, including driver installation procedures, are provided on the Compaq SSD for IBM OS/2 diskette. Locate and read these procedures. If the installation procedures differ from the instructions below, use the procedures on the SSD diskette.

View or print the Readme files:

1. When prompted, insert Compaq SSD for IBM OS/2 installation diskettes into the diskette drive.
2. From the OS/2 prompt, type:

A:\VIEWME
3. Use the HTML links to navigate the documentation or press **F7** to print.

NOTE: To print the file, the server you are configuring must be connected to a printer.

Installing the Driver

Install the driver file to the OS/2 directory on your boot drive:

1. Place the Compaq SSD for IBM OS/2 installation diskette labeled System and Storage Drivers into the diskette drive.
2. From the OS/2 command prompt, type:

A: Ddinstal
3. Click Change to change the source directory to A:/ADD.
4. Select Compaq Array Driver for OS/2 from the list of drivers.
5. Click OK to continue.

The *CPQARRAY.ADD* driver file is copied to the *x:\os2* directory (where *x* is the boot drive) and the *CONFIG.SYS* file is updated to load the driver first at startup. In other words, the drive on this controller is the boot drive.

IMPORTANT: To boot from a drive attached to the integrated SCSI controller, or other drive, change the *CONFIG.SYS* file before you reboot the server. Edit the *CONFIG.SYS* file to reorder the *BASEDEV=CPQARRAY.ADD* statement so that it appears after the *BASEDEV* statement corresponding to the boot driver.

6. Save the updated *CONFIG.SYS* file and exit the editor.
7. Perform a normal system shutdown and restart the server to load the new driver.
8. Proceed to the last section in this chapter, “Updating the Compaq Insight Management Agents.”

Controller Ordering

Two factors determine controller ordering in a system operating in an IBM OS/2 environment:

- The order of ADD drivers specified in the *CONFIG.SYS* file determines the order of types of controllers relative to other types of controllers.

A single ADD driver groups all of the controllers in its array together. Among a group of ADD drivers, the first ADD driver to appear in the *CONFIG.SYS* file has its controllers ordered first, the second ADD driver has its controllers ordered after the first driver controller, and so on.

Only the order shown in *CONFIG.SYS* affects the order. The slot in which the controller is installed does not affect the loading order.

- Each ADD driver developed by Compaq orders its controllers in ascending order based on the controller order assigned by the Compaq System Configuration Utility.

Use the following rules to ensure proper controller functioning and ordered interaction with other storage controllers in the system.

NOTE: The Compaq System Configuration Utility does not automatically enforce the recommended array configuration rules. Follow these rules carefully when you manually configure the system.

- Compaq array controllers should be stored in consecutive order as a group.
- When you boot from the Compaq Integrated Smart Array Controller, the statement *BASEDEV = CPQARRAY.ADD* must be present in *CONFIG.SYS*.

Partitioning

Observe the following limitations for IBM OS/2 on any computer system:

- The maximum allowed partition size on FAT is 2 GB (2048 MB).
- It is recommended that you do not exceed 8 GB for an HPFS boot partition. If you exceed this size, the disk may run out of working room for the OS/2 system files and prevent the ROM from loading system files on start up.
- This driver has been tested with HPFS partition sizes of up to 40 GB. Do **not** create partitions exceeding 40 GB on any of the RAID volumes in an OS/2 environment.

The IBM OS/2 operating system may allow the creation of partitions beyond these specified boundaries, but you should adhere to the functional limits outlined above to ensure proper functionality.

Booting OS/2 from a Integrated Smart Array Controller Drive

This section describes additional information for starting OS/2 from a Compaq Integrated Smart Array Controller.

The *CPQARRAY.ADD* driver must always be present when booting from the Integrated Smart Array Controller. If the controller is the primary disk controller, edit the *CONFIG.SYS* file to ensure that the first BASEDEV entry present is:

```
BASEDEV=CPQARRAY.ADD
```

This ordering guarantees that the *CPQARRAY.ADD* driver is the first ADD driver loaded and that the operating system assigns the first hard drive on the Integrated Smart Array Controller as the boot drive. For example:

```
BASEDEV=CPQARRAY.ADD
```

```
BASEDEV=CPQ53CX.ADD
```

If OS/2 boots from another controller, order the other controller first:

```
BASEDEV=AMSI02.ADD
```

```
BASEDEV=CPQARRAY.ADD
```

Command Line Switches

There are several command line switches available for modifying the standard behavior of the Compaq ADD driver. The syntax for command line switches is:

■ /V

The Verbose Mode command line switch is a standard command line switch that instructs the driver to print information to the screen as it loads. The screen displays the current driver name and version number along with information about associated adapters and drives. Adapter information includes IRQ assignment, slot number, and configuration order number. Drive information includes physical drive count, logical drive count, and geometry information for each logical drive.

Verbose Mode command line may be written as:

BASEDEV=CPQARRAY.ADD /V

■ /A:[adapter index] [unit parameters]

This is a standard command line switch that instructs the driver to modify its behavior toward adapters.

- The [adapter index] is the number that identifies a controller. The index is based on '0' for the lowest controller order number associated with the adapter controlled by this ADD. The index number is incremented by one for each controller in the system as you move up the controller configuration order.

The table below shows a system with three adapters controlled by the *CPQARRAY.ADD*. The lowest configured adapter is the secondary controller.

Table 5-1
Controller Order and Adapter Index

Controller Order	Adapter Index
2	0
3	1
5	2

- [unit parameters] This ADD only supports the /I parameter containing the command to ignore a controller.

■ /I Ignore

The Ignore command line instructs the controller to ignore the specified adapter, bypass controlling the adapter with the specified drive, or prevent the ADD driver from recognizing the specified adapter. Use this command to allow another driver to control the specified adapter.



CAUTION: Do not use this command line to ignore the primary, or boot, controller. If the boot controller is ignored, your server will not start.

Ignore command line example:

The following statement prevents the ADD driver from claiming adapter 2:

```
BASEDEV=CPQARRAY.ADD /A:2 /I
```

This example applies when you are running NetWare on your OS/2 2.x system and you want a NetWare NLM to control adapter 2 instead of configuring the ADD driver to control adapter 2.

Banyan VINES 7.0 or Later

Installing the Driver

Use the instructions in this section to install the initial driver for a new Integrated Smart Array Controller installation or to upgrade the driver in an existing Banyan VINES 7.0 or later version server with an installed Integrated Smart Array Controller. Consult your software user documentation for additional Banyan VINES installation guidelines.

Additional Information

The last Peripheral Adapter Support Software diskette for installing the controller driver is created from the SmartStart CD or from SoftPaq and is a bootable DOS documentation diskette. The *README.SSD* file on this diskette contains a short description of the drivers and includes a procedure for installing the Integrated Smart Array Controller driver. If you need to create installation diskettes, refer to the section called, “Creating Banyan VINES Peripheral Adapter Support (PAS) Diskettes.”

Installation Procedures

To install the Integrated Smart Array Controller driver for Banyan VINES version 7.0 or later, follow the installation procedures specified in the *README.SSD* file.

When installation of the Integrated Smart Array Controller and driver is complete, restart the server to load the driver. Refer to “Updating the Compaq Insight Management Agents” for additional information.

Updating the Compaq Insight Manager Agents

If you are using Compaq Insight Manager, update the Insight Agents to support the new Integrated Smart Array Controller. If you used SmartStart 4.4 or later to install the operating system on a new Integrated Smart Array Controller installation or to upgrade your driver for an existing installation, the agents were updated for you automatically by SmartStart and do not have to be manually updated.

The correct agents can be obtained from your local Compaq authorized reseller or Compaq authorized service provider. Refer to the documentation included with Compaq Insight Manager for the correct procedure for updating agents.

Installation of the Compaq Integrated Smart Array Controller is now complete. Reboot the server to begin using the array controller.

Chapter **6**

Compaq Array Configuration Utility

This section provides instructions for using the Compaq Array Configuration Utility (ACU) and describes methods or wizards you can use to configure your controller quickly and easily. This section is divided into seven subsections, listed below. Read the first five subsections and use the last two as reference material when needed.

- Before You Begin
- Running the Compaq Array Configuration Utility
- Configuration Wizards
- Online Help
- Array Configuration Utility Screens
- Configuration Procedures
- Errors and Warnings

The Array Configuration Utility, located on the SmartStart and Support Software CD, is a graphics-based application that helps you configure the Compaq Integrated Smart Array Controller. You can use the Array Configuration Utility to configure or reconfigure the Integrated Smart Array Controller.

The Array Configuration Utility provides the following configuration benefits:

- Easy-to-understand graphical format for controller configuration
- Descriptions of various configuration errors
- Configuration wizards that walk you through the configuration process
- Prompts for optimal configuration and fault-tolerance profiles for unconfigured controllers

Before You Begin

Complete the following tasks during a first-time installation and configuration of the Integrated Smart Array Controller:

- Install the Integrated Smart Array Controller board.
- Update the system ROM with System ROMPaq, if needed. See Chapter 3, “Updating Firmware,” for additional information.
- Run Option ROMPaq to update the controller firmware, option ROM, and drive firmware, if needed.
- Run the System Configuration Utility to verify the controller order settings.
- Decide which fault-tolerance method and array configuration you want to use.

Running the Compaq Array Configuration Utility

The Array Configuration Utility can be run either online or from the SmartStart and Support Software CD provided with your server.

SmartStart and Support Software CD

Run the Array Configuration Utility directly from the SmartStart and Support Software CD on any CD-bootable server:

1. Insert the SmartStart and Support Software CD into the CD-ROM drive and power up the server.
2. From the display screen, select the Array Configuration Utility.

3. Follow the onscreen instructions to configure the Integrated Smart Array Controller.
4. After completing configuration, remove the CD from the CD-ROM drive and restart the server.

ACU Online

If the server you are configuring is running Microsoft Windows NT or Novell NetWare, you can install and run the Array Configuration Utility online. For other operating systems, use the Array Configuration Utility provided on the SmartStart and Support Software CD or follow the instructions for your operating system specified in this chapter.

Microsoft Windows NT

When you run the Compaq SSD for Windows NT Diskette, you are prompted to insert the Array Configuration Utility diskettes to install the utility. Select the program icon to run the Array Configuration Utility. The Windows NT online Array Configuration Utility requires that at least one logical drive be previously configured offline.

Novell NetWare

The Compaq Array Configuration Utility for Novell NetWare (*CPQONLIN.NLM*) is available on the Support Software for Novell Products (NSSD) diskettes in the \ONLINE directory. Generate the NSSD diskettes using the Diskette Builder feature in SmartStart. The NSSD diskettes have an *ARRAY.RDM* Readme file to access instructions on loading and using *CPQONLIN.NLM*.

Configuration Wizards

When you start the Array Configuration Utility, the software checks the configuration of the Integrated Smart Array Controller board and its drive arrays.

If the arrays are unconfigured **or** if the configuration is less than optimal, the configuration wizard takes over to guide you through the configuration process. The configuration wizard recognizes the following conditions:

- **Unconfigured controller**

When the Array Configuration Utility detects an unconfigured controller, the configuration wizard steps you through the controller configuration process.

- **Unused physical drives**

When the Array Configuration Utility detects unused physical drives, the configuration wizard provides an easy way to create a new array. The capacity expansion capability of the Integrated Smart Array Controller allows the ACU to add new physical drives to an existing array without destroying data on the existing logical drives.

- **Unused space on an array**

If the Array Configuration Utility detects unused capacity in an array, the configuration wizard steps you through the process of configuring the space into one or more logical drives.

Online Help

Press **F1** or select the Help button to activate context-sensitive help for each screen. A status bar at the bottom of the screen also provides immediate help messages describing the current selection.

Array Configuration Utility Screens

This section discusses the various screens and options you can use to navigate the Compaq Array Configuration Utility.

Main Configuration Screen

The main configuration screen is the first screen displayed after the configuration wizards have been completed. As you select certain items, some areas are highlighted while others appear gray. You cannot select grayed-out areas until you select an item in the list frame that provides that option.

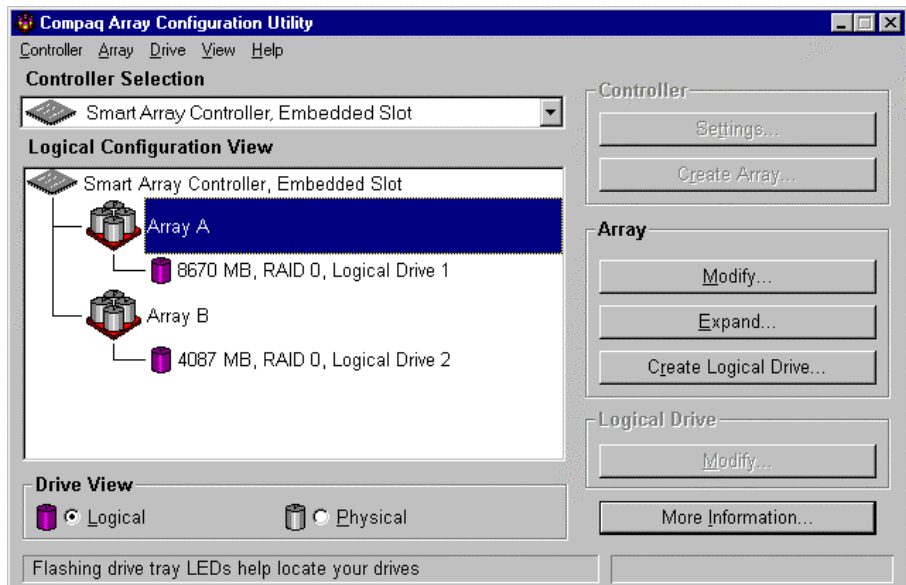


Figure 6-1. Main configuration screen

Elements of the main configuration screen include:

- Menu bar
- Controller Selection frame
- Logical/Physical Configuration View frame
- More Information bar
- Drive View buttons
- Controller buttons

- Array buttons
- Logical Drive button

Menu Bar

The menu bar contains the following pull-down menus:

- Controller
 - ☐ Select a controller
 - ☐ Save a configuration
 - ☐ Create an array
 - ☐ Exit the program
- Array
 - ☐ Delete the capacity of an array
 - ☐ Change the capacity of an array
 - ☐ Create logical drives
- Drive
 - ☐ Delete logical drives
 - ☐ Modify logical drives
 - ☐ Extend logical drives
 - ☐ Migrate RAID/Stripe Size of a logical drive
 - ☐ View drive information
- View
 - ☐ Physical Drive View
 - ☐ Logical Drive View
- Help
 - ☐ Help contents
 - ☐ Search
 - ☐ Other online help

Controller Selection Frame

The Controller Selection frame is located in the upper left corner of the Main Configuration screen. A drop-down menu lists all the controllers that are installed in the present system and available to view or configure. Highlighting the controller you want to view or configure activates the option buttons on the right side of the screen.

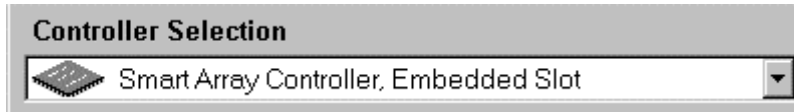


Figure 6-2. Controller Selection frame

Logical/Physical Configuration View Screen

The Logical/Physical Configuration View provides a graphical representation of all the drives and arrays associated with the selected controller. Located next to each controller icon is the name of the controller and the slot in which it is installed.

For each controller, the drive arrays, logical drives, and physical drives associated with that controller are listed. Use the Drive View buttons, located below the Logical/Physical Configuration View frame, to select either the logical or physical viewing option.

The figure below shows an example of the Physical Drive View screen for an Integrated Smart Array Controller in the Array Configuration Utility. This controller has two drive arrays; Array A contains one 9.1-GB hard drive, and Array B contains one 4.3-GB hard drive. The port allocations and ID numbers for each physical drive are also shown in this view option.

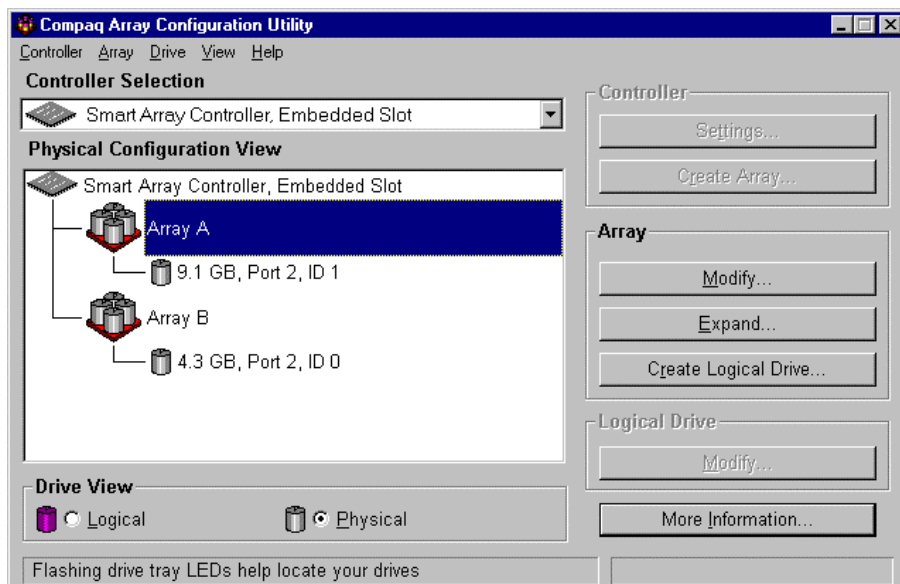


Figure 6-3. Physical Configuration View screen

More Information Bar

The More Information bar is located at the lower right side of the screen. Select this option to display a list of the controller, drive, and array configuration details available for the selected items.

Drive View Buttons

This area, shown below, is located at the lower left side of the screen. The Drive View frame lets you switch between logical and physical drive views. Select the representation you would like to see in the Configuration view frame.



Figure 6-4. Drive View buttons

Controller Buttons

The Controller frame in the upper right corner of the screen becomes active when you select a controller in the Controller Selection frame.

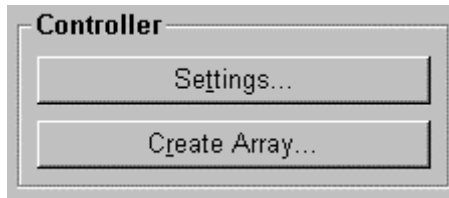


Figure 6-5. Controller buttons

Select the Settings button to display the Controller Settings screen. Select the Create Array button to display the Create Array screen. Detailed information about the two controller option screens is provided later in this chapter.

Array Buttons

The Array frame is located on the right side of the screen, under the Controller frame. It becomes active after you select an array in the Physical Configuration View frame. Array buttons allow you to modify, expand, or create a logical drive by reconfiguring existing drive space.

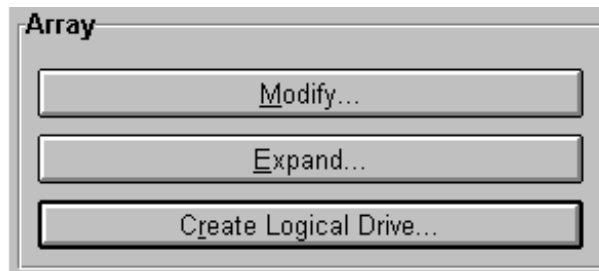


Figure 6-6. Array buttons

Logical Drive Button

This frame is located on the right side under the Array frame. It becomes active when you select a logical drive in the Logical Configuration View frame. The Logical Drive button allows you to modify a selected logical drive without rewriting the array configuration.

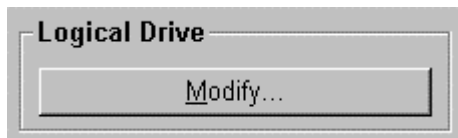


Figure 6-7. Logical Drive button

Controller Settings Screen

The Controller Settings screen contains three configuration elements:

- Operating System
- Rebuild Priority
- Accelerator Ratio

If you have installed and configured your operating system with SmartStart or manufacturer software, the current operating system is shown in the Operating System frame. Use the pull-down menu to load a different operating system.

Select your rebuild priority with the High, Medium, and Low buttons. Rebuild Priority selections have no impact on an idle system but will affect performance on a busy system.

The Rebuild Priority affects the amount of time the controller spends rebuilding data after a failed drive has been replaced. Select High if rebuilding data should take precedence over handling requests from the operating system. Select Low if the controller should rebuild data only when it is idle.

The Accelerator Ratio frame displays the amount of read-and-write cache available on the controller. The Integrated Smart Array Controller contains read cache space only. The ratio shown will always be 100% read to 0% write.

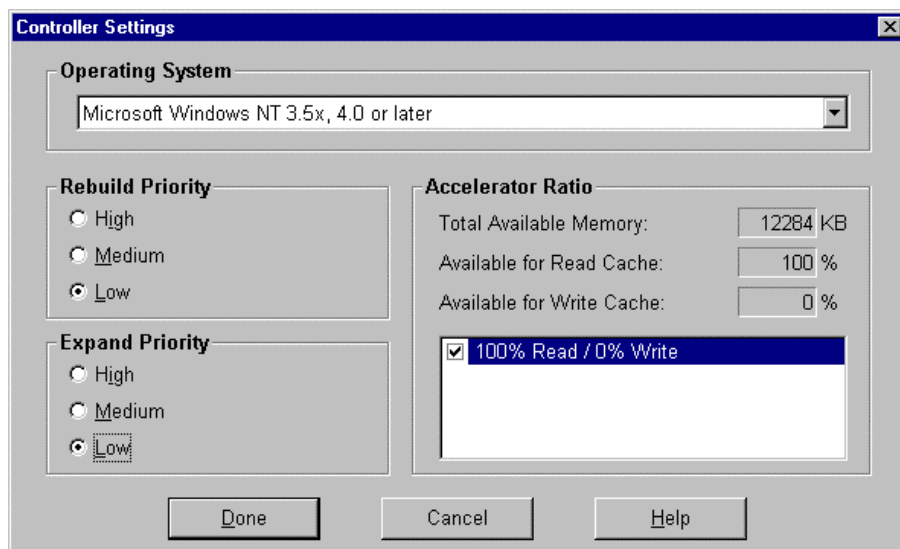


Figure 6-8. Controller Settings screen

Create Drive Array Screen

In the Create Drive Array screen, all available drives attached to the selected controller are listed in the left window and drives assigned to the current array appear in the right window. A port number and SCSI ID identify each drive.

To create an array, select the logical drives from the drive frame to use in the array and move them into the array frame by selecting the Assign Drive to Array button in the center of the screen. You can also select a drive and drag it to the array window. To assign a spare, select the drive to be the spare and then select the Assign Spare to Array button at the bottom of the screen.

Always group physical drives of the same size together. If you mix drive sizes, the Integrated Smart Array Controller treats all the drives as the same size as the smallest drive in the array, which results in wasted capacity in the larger drives.

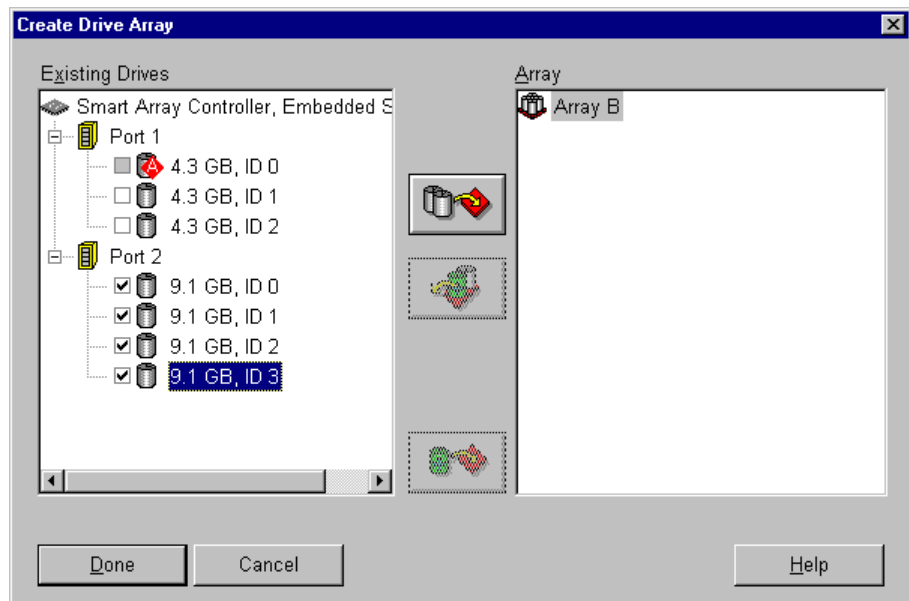


Figure 6-9. Create Drive Array screen

Create Logical Drive Screen

From the Create Logical Drive screen, you can select the fault-tolerance method, enable or disable the array accelerator, set the logical drive size, and set the stripe size.

The Integrated Smart Array Controller supports four fault-tolerance levels:

- RAID 5
- RAID 1
- RAID 0+1
- RAID 0

The Fault Tolerance frame allows you to select the appropriate RAID level.

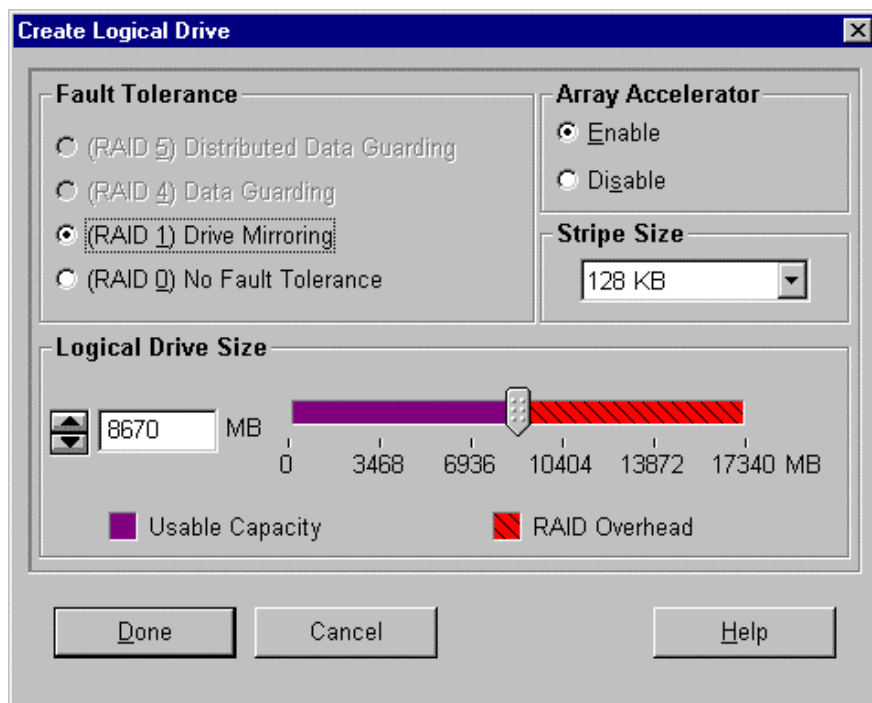


Figure 6-10. Create Logical Drive screen

The Logical Drive Size area shows a scale marked with the amount of drive capacity available for the logical drive selected from the main configuration screen. The utility does not allow you to create a logical drive larger than the maximum supported by the operating system.

The purple (left) band on the scale indicates the fraction of the total that is available for data. The striped red (right) band indicates the fraction required for storing the parity or mirrored information depending on the fault-tolerance method used. The red (right) band is only needed for RAID 1, RAID 0+1, or RAID 5.

This area displays the maximum-sized logical drive that can be created for your drive array. You can reduce this amount if you want to create more than one logical drive on the array. To reduce the size, type the number in or drag the pointer to the left. Fine-tune the size with the arrow buttons to the left of the scale.

Array Accelerator Frame

The Integrated Smart Array Controller offers an 8-MB read cache option. The Array Accelerator frame allows you to disable this function.

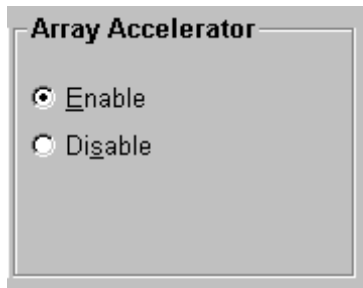


Figure 6-11. Array Accelerator frame

Stripe Size

Stripe size refers to the amount of data stored on each physical drive in one stripe of a logical drive. Each RAID level has a default value plus a range of supported sizes. The default values shown in the following table provide optimum performance for that RAID level in many applications. However, your application may benefit from setting the stripe size to a different value.

To select a stripe size other than the default, select the down arrow next to the current stripe size and select from the sizes available.

Table 6-1
Stripe Size Fault Tolerance

Fault-Tolerance Level	Default (KB)	Valid Stripe Sizes (KB)
Raid 0	128	8, 16, 32, 64, 128, 256
RAID 1/RAID 0+1	128	8, 16, 32, 64, 128, 256
RAID 5	16	8, 16, 32, 64*

* RAID 5 does not support stripe sizes larger than 64KB per drive.

Online RAID Level and Stripe Size Migration

To change the RAID level and stripe size without loss of data or system disruption, use the Online RAID Level and Stripe Size Migration screen. From this screen you can reconfigure a currently configured logical drive to a new fault-tolerance (RAID) level or a new stripe size.

Novell NetWare Online Array Configuration Utility

The Novell NetWare Online Array Configuration Utility, also called CPQONLIN, is an NLM for configuring your drive arrays without shutting down your server. CPQONLIN also provides information about the status of drives attached to the Integrated Smart Array Controller. This utility indicates drive failure, expansion, or waiting for expansion or rebuild (queued). Before loading *CPQONLIN.NLM*, you must load the appropriate device driver—*CPQARRAY.HAM*. *CPQONLIN.NLM* is located in the ONLINE directory of Novell SSD Disk 4. See driver installation information in the NetWare section of Chapter 5.

Autoconfiguration

If no logical drives are configured, a CPQONLIN autoconfiguration wizard, shown in the following figure, appears and prompts you to select fault-tolerance information. CPQONLIN then configures arrays optimally for the selected fault tolerance.

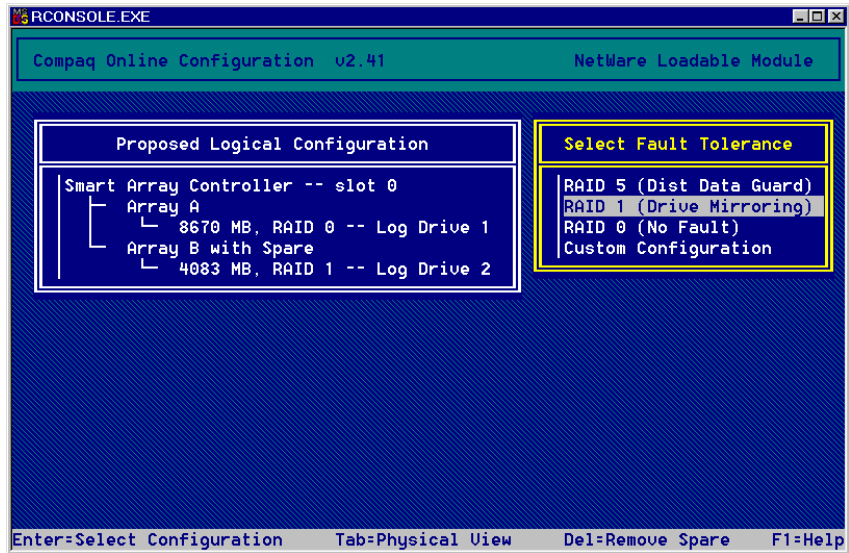


Figure 6-12. NetWare autoconfiguration wizard using RAID 1 fault tolerance

Custom Configuration

Custom configuration allows you to create arrays and to assign fault tolerance one array at a time. To custom configure an array, make selections from the main configuration screen. Highlight the controller, array, or logical drive you want to configure. Make a selection from the Options menu located on the right side of the screen. The figure below shows the main configuration screen with the controller highlighted on the left side of the screen and controller options on the right side of the screen.

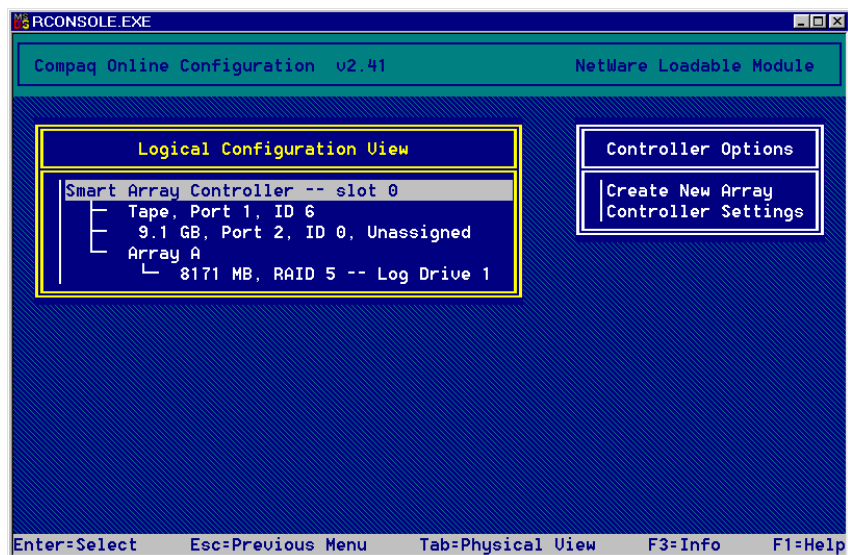


Figure 6-13. NetWare Main Configuration screen

Use online help for instructions to complete configurations. The following sections discuss CPQONLIN functions.

Drive Rebuild, Expand Priority and Accelerator Ratio

To set the drive rebuild priority, expand priority, or accelerator ratio for a controller, highlight the controller at the main configuration screen and select the Controller Settings option listed below Controller Options.

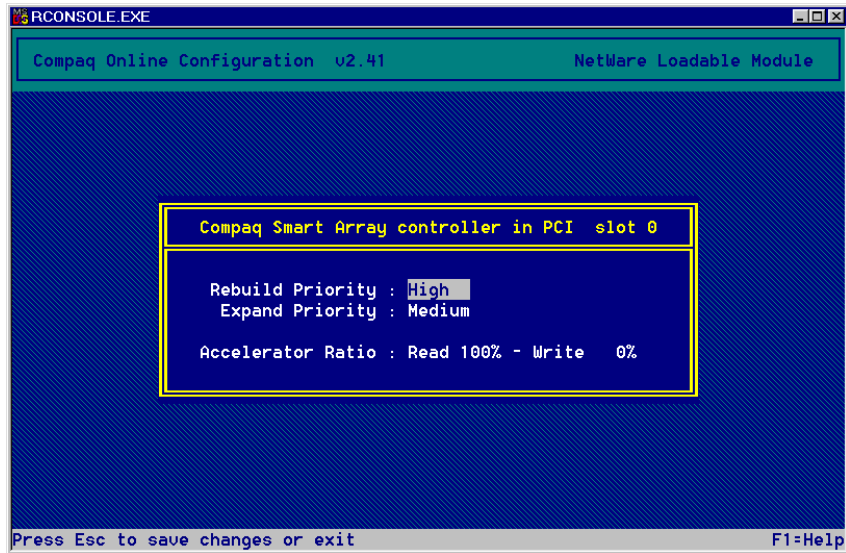


Figure 6-14. NetWare Controller Settings screen

NOTE: The figures in this section represent typical NetWare screen displays. Different versions of the software may present slightly different server displays.

Drive Rebuild

Drive rebuild is required after a physical drive fails and is replaced. Only logical drives configured for a fault-tolerance level (RAID 5, RAID 1, RAID 0+1, or RAID 0) on the array with the failed physical drive can be rebuilt.

Priority Settings

To set the drive rebuild priority, highlight the Integrated Smart Array Controller in Controller Options frame and select Controller Settings. If you choose low priority for a drive rebuild, drive rebuilding takes place when the drive is idle. If you choose high priority, drive rebuilding takes place while the drive is active, at the expense of normal I/O operations. Choosing high priority for drive rebuilding protects the array, but the array is vulnerable to additional drive failures while a drive is both in operation and being rebuilt.

Accelerator Ratio

The Integrated Smart Array Controller onboard cache only performs read-ahead caching. Therefore, the ratio is always 100% read to 0% write. This read cache option can be disabled in the Array Accelerator frame on the Create Logical Drive screen.

Expand an Array

Overall server performance may be slightly degraded during an array expansion procedure. In most cases, degradation can be offset with additional physical drives.

- To further minimize performance degradation, perform the capacity expansion process during periods of low server use. If you must expand during peak periods, the Array Configuration Utility for NetWare allows you to set the priority of the expansion. Setting a low priority affects performance the least, but it takes longer for the new space to become available.
- For expansion purposes, avoid using drives that have a greater capacity than the smallest drive in the array. Adding larger drives wastes space because only the space that is equal to the smallest drive size can be used.

Add or Configure Spare Drives

When adding a spare drive to an array, you must have an unassigned drive or a drive already assigned as a spare on another array. You can assign a single spare to as many arrays as you want, or assign separate spares. When you select Assign Spare Drive, only drives that qualify will appear. For example, only those spares that are large enough will appear. If drives that you expect to see do not appear, switch to the physical drive view and check the size of the drives. The spare must be as large as the smallest drive in the array.

Online RAID and Stripe Migration

Using CPQONLIN, you can modify both the RAID level and stripe size of an existing logical drive while online. To migrate a drive, select the drive setting option under the logical drive menu for the drive you wish to modify. Select the new RAID level and/or stripe size from the choices presented to you. If the new settings are valid, the migration begins when you save your changes.

Failed Drives or Interim Recovery Mode

If a drive fails and hardware fault tolerance is enabled, system operations continue. Replace the drive as soon as possible. To recover a drive and use the failed drive in the interim, select a logical drive and press **F3** to monitor the status of drive recovery, as shown in the figure below.

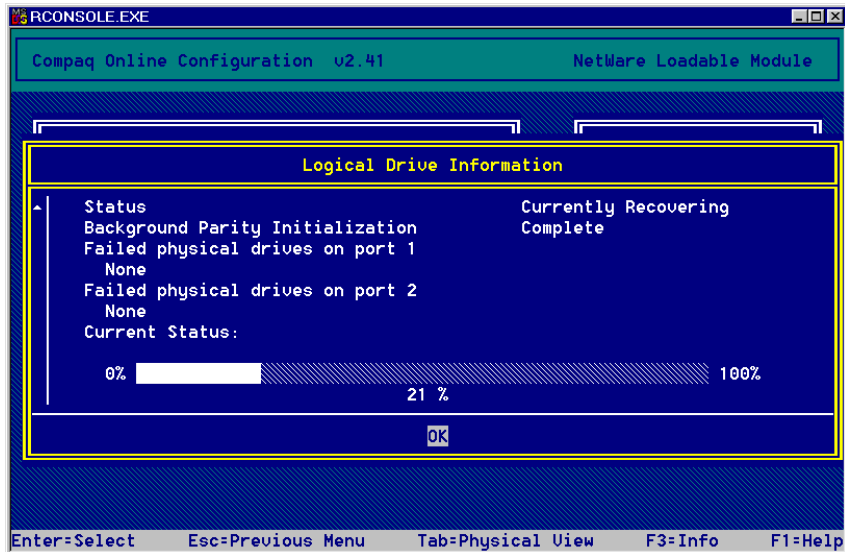


Figure 6-15. Logical Drive Information screen

■ Interim Recovery

The logical drive is operating, but a failed drive has not been replaced. Replace the failed drive as soon as possible.

■ Ready for Recovery

The logical drives are queued for recovery. This status is displayed when another logical drive is already rebuilding or expanding.

■ Rebuilding

The array is operating and rebuilding a replacement drive or an online spare, if one was assigned.

■ Logical Drive Failed

If you have one or more logical drives in an array that are not protected by fault tolerance, the data on those logical drives are lost. The Array Configuration Utility status window shows the logical drives as Failed. After drive replacement, fault-tolerant logical drives rebuild and the logical drives that were not protected become available for data (the devices are reactivated automatically). After drive recovery and replacement is complete for the whole array, restore lost data from your backup data set.

If you do not replace the failed drive, the Array Configuration Utility requires you to delete the affected logical drives.



CAUTION: Deleting failed logical drives results in a loss of all data stored on the drive.

NOTE: Drive failure can occur on drives protected by fault tolerance if two or more physical drives fail concurrently.

Some status indicators activate without pressing **F3**. For example, on the Main Configuration menu, a FAILED status message appears beside the failed logical drive. EXPANDING and REBUILDING messages appear next to the array in which the corresponding activity occurs.

Handling Disk Drive Failures

If you configured your Integrated Smart Array Controller with hardware fault tolerance, complete the following steps after a physical disk drive failure:

1. Determine which physical drive failed. On hot-plug drives in a ProLiant server or storage system, an amber Drive Failure LED on each drive tray indicates failure.
2. If the unit containing the failed drive does not support hot-plug drives, perform a normal system shutdown.

3. Remove the failed drive and replace it with a drive that is of the same capacity. For hot-plug drives, after you secure the drive in the bay, the LEDs on the drive each light once in an alternating pattern to indicate that the connection was successful. The online LED blinks, indicating that the controller recognized the drive replacement and began the recovery process.
4. Ensure that server power is on. If you shut down the server in Step 2, power the server back up.
5. The Integrated Smart Array Controller firmware reconstructs the information on the new drive based on information from the remaining physical drives in the logical drive. While reconstructing the data on hot-plug drives, the online indicator blinks. When drive rebuild is complete, the online indicator stays lighted.
6. NetWare cannot detect a physical drive failure when using hardware-based fault tolerance; NetWare determines that the data is still valid and accessible during the rebuilding process. However, the driver does know that a physical drive has failed. A message will be printed on the console notifying the user a physical drive is in a degraded state. CPQONLIN will also show the drive has failed.

Optimizing Array Controller Performance for Novell Systems

To improve system performance, keep these tips in mind before creating NetWare volumes or partitions:

- If you selected a fault-tolerance option during configuration, such as mirroring or distributed data guarding, do not select mirroring while using *INSTALL.NLM* or *NWCONFIG.NLM*. The fault-tolerance capabilities of the Integrated Smart Array Controller already provide performance improvements and automatic data recovery features.
- Novell recommends that you create volumes with a 64-KB block size and that you use the Block Sub-Allocation feature of NetWare. The large block size decreases the amount of RAM required to mount the volume, and suballocation allows NetWare to allocate disk space more efficiently.
- Using linear memory provides the best drive performance in a NetWare environment. When you use the Compaq System Configuration Utility to configure your server with NetWare, the memory options default so that linear memory is used. To verify the setting, run the Compaq System Configuration Utility and view the memory settings. Make sure that a linear option is selected under the Base Memory option.

Configuration Procedures

Creating a New Array

This section provides instructions for creating or modifying new arrays after you have installed your operating system. If you are configuring a new array, the configuration wizard leads you through the process. If you want to bypass the wizard, use the following procedures to create your array.

Creating a new array involves the following general steps:

- Choosing a controller for the array
- Grouping physical drives of the same size into an array
- Subdividing the array into one or more logical drives

The following example illustrates how to use the Array Configuration Utility to create a new array.

For this example, make the following assumptions:

- Array A contains at least one physical drive that has been configured as a logical drive and contains the operating system.



CAUTION: Do not modify the logical drive that contains the operating system. Modifying this drive can result in loss of data.

- Four 9.1-GB drives and two 4.3-GB drives are connected to the Integrated Smart Array Controller. The operating system is not installed on any of these drives.
- Two new arrays will be configured. Array B consists of three 9.1-GB drives with the fourth 9.1-GB drive used as a spare. Array C contains the two 4.3-GB drives.
- The fault-tolerance method for all logical drives on Array B is RAID 5, Distributed Data Guarding. The fault-tolerance method for all logical drives on Array C is RAID 1, Drive Mirroring.

Choosing a Controller for the Array

Start the Array Configuration Utility from the SmartStart and Support Software CD. From the Main Configuration Screen, select the Controller Selection frame. You can also select Controller/Select from the main menu.

1. Select one of the controllers listed in the Controller Selection frame.

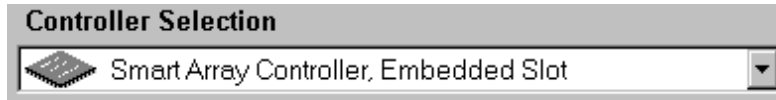


Figure 6-16. Controller Selection frame

2. Select the Settings button shown below.

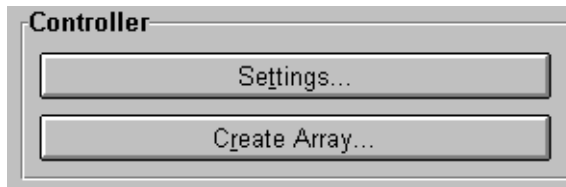


Figure 6-17. Controller buttons

3. At the Controller Settings screen, select your operating system.

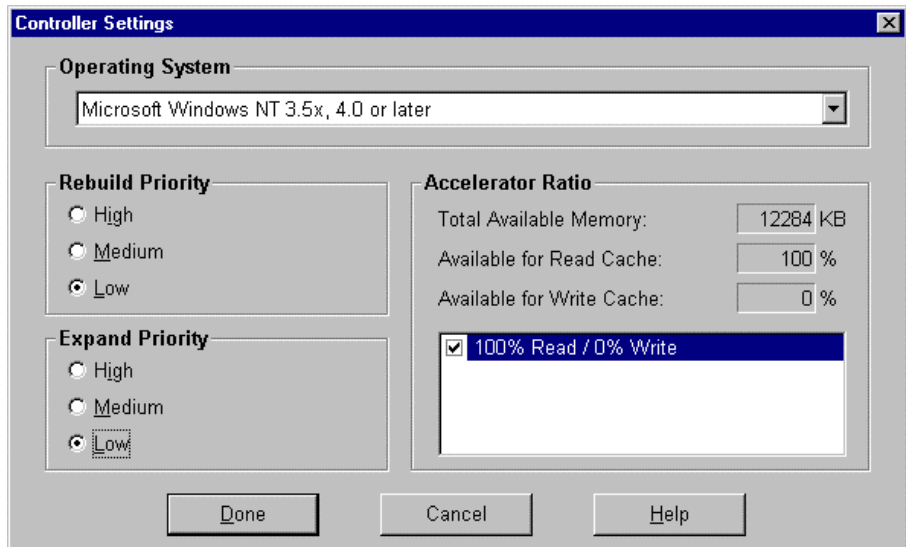


Figure 6-18. Controller Settings screen

4. Select the Done button to save settings and exit.

Grouping Physical Drives of the Same Size into an Array

This procedure creates two new arrays: Array B and Array C. Array A contains the operating system and will not be used or modified.

1. In the Controller Selection frame, select the Smart Array Controller, Embedded Slot.
2. Select the Create Array button. The Create Drive Array screen is displayed.

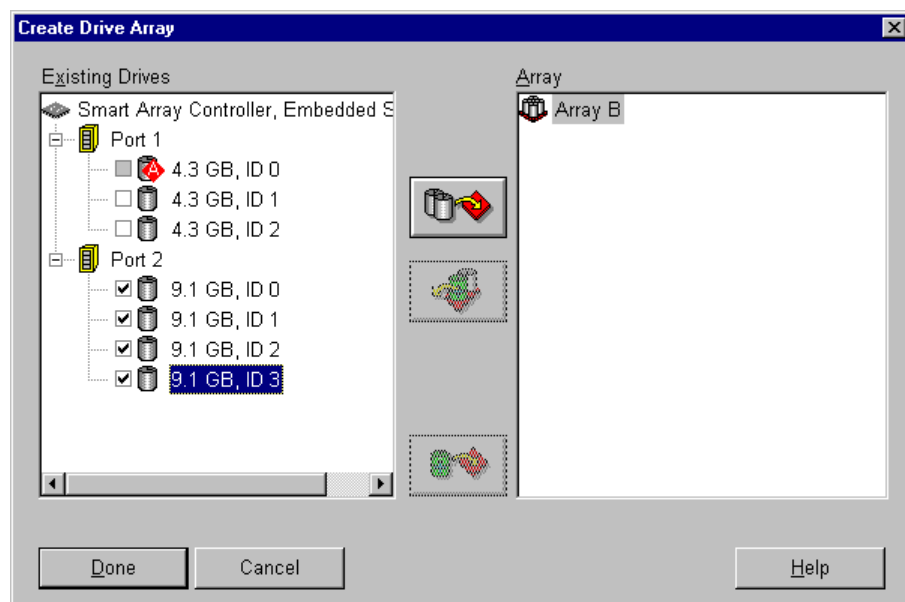


Figure 6-19. Create Drive Array screen

3. Select the four 9.1-GB drives you want to use in array B from the drives listed in the Existing Drives frame.

NOTE: Always group physical drives of the same size. The Integrated Smart Array Controller treats all the drives as the same size as the smallest drive in the same array. If you mix drive sizes, the capacity of the largest drive is wasted.

For this example select the following drives:

Port 2:SCSI ID 0
 Port 2:SCSI ID 1
 Port 2:SCSI ID 2

4. Select the Assign Drive(s) to Array button.
5. Select the drive at Port 2:SCSI ID 3 and select the Assign Spare to Array button. The right side of the Create Array screen should now look similar to the figure below.

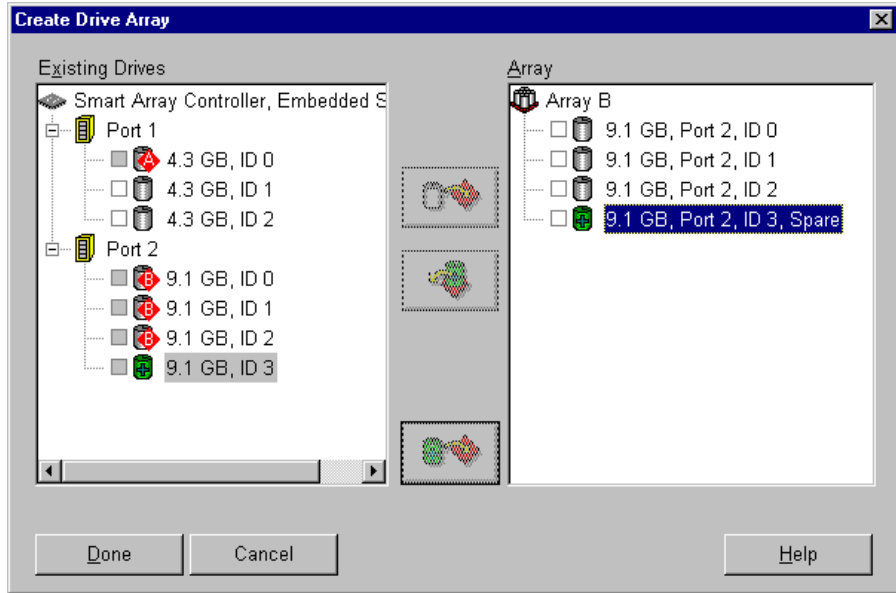


Figure 6-20. Example Array B

NOTE: The same spare drive may be assigned to multiple arrays. However, spare drives must have the same or greater capacity as the drives in the array.

6. Select the Done button to return to the main configuration screen. The Logical Configuration View frame should now look similar to the following figure.

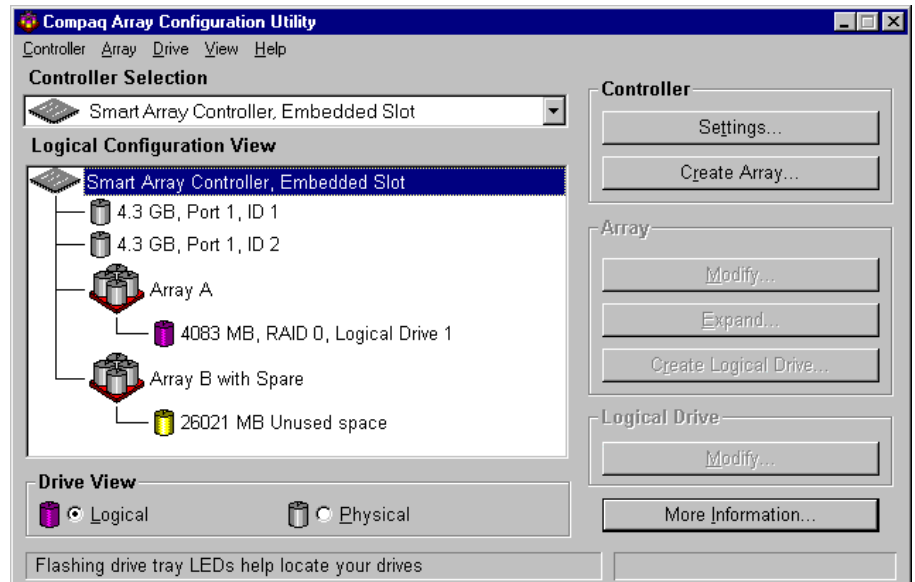


Figure 6-21. Logical Configuration View frame with one configured array

7. Select your controller from the pull-down menu in the Controller Selection frame.
8. Select the Create Array button to create Array C.
9. Assign both 4.3-GB drives to the array.
10. Select the Done button to save the array and exit.

Creating Logical Drives Across Physical Drives

When creating a logical drive, you can select a fault-tolerance (RAID level) option and provide information regarding the drive size and array accelerator.

1. Select Array B or the Unused Space icon under Array B in the Logical Configuration View.
2. Select the Create Logical Drive button. A screen similar to the following figure displays.

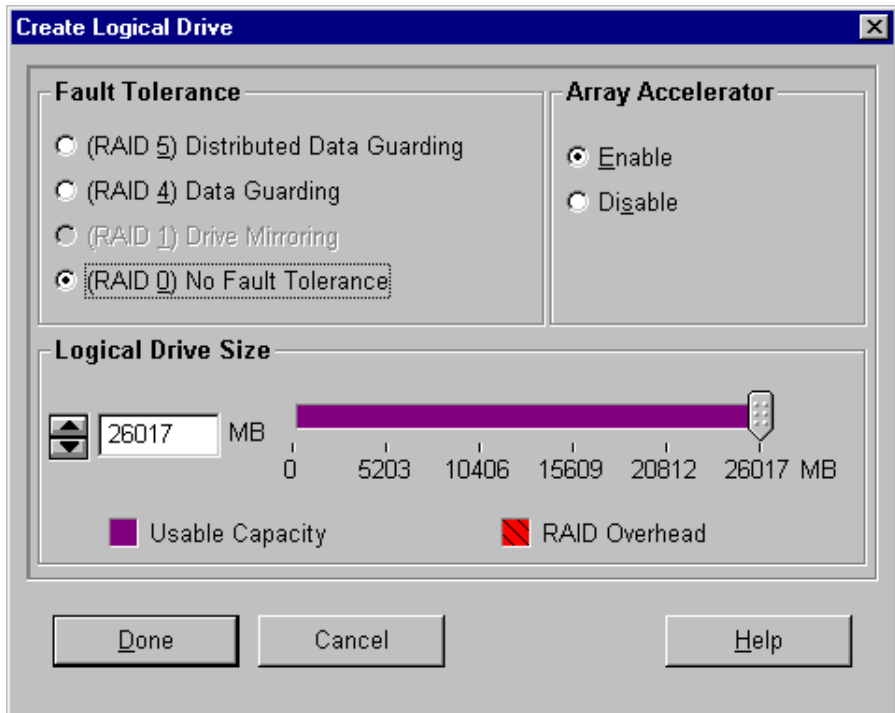


Figure 6-22. Create Logical Drive screen

3. In the Fault Tolerance frame, select the Distributed Data Guarding (RAID 5) option.
4. The Logical Drive Size area shows a graphical representation of the storage capacity available. To create a single logical drive across this array, accept the default values. Refer to the section titled “Create Logical Drive Screen” later in this chapter for a detailed description of this procedure.

NOTE: Because the size of the logical drive depends on the number and size of drives used in the array, there is no right or wrong logical drive size.

5. Select the Done button.
6. Select Array C or the Unused spare icon under Array C in the Logical Configuration View.
7. Repeat Steps 2 through 5 to create a single logical drive across Array C, this time selecting the RAID 1 fault-tolerance option.
8. The Logical Configuration View screen appears as shown in the figure below.

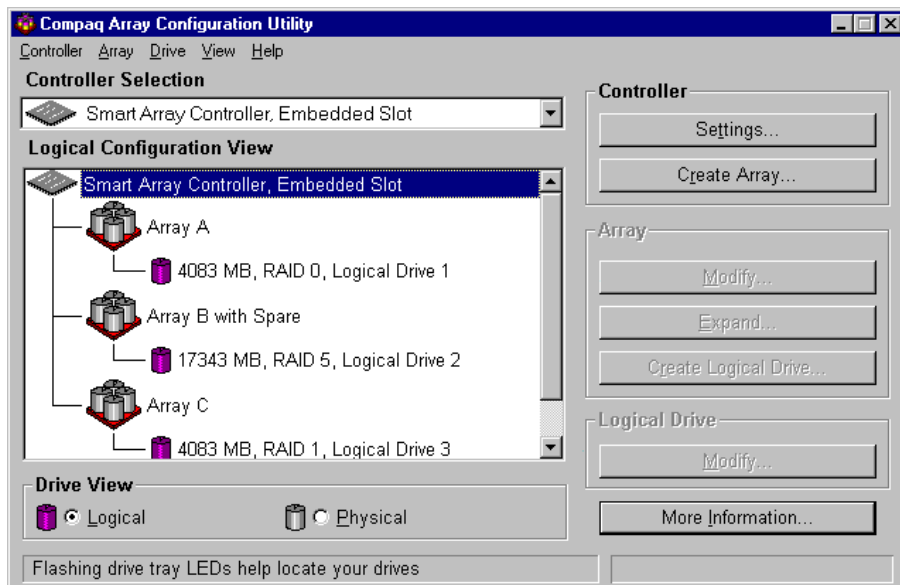


Figure 6-23. Logical Configuration View window showing three arrays with different RAID assignments

9. At the main screen, pull down the Controller menu, then select Save Configuration. This saves the new settings for logical drive 2 and logical drive 3.

Expanding Capacity

Expanding array capacity involves adding storage capacity to an array that has already been configured without disturbing the existing data by adding new physical drives to the array.

When you run the Array Configuration Utility, the program checks the drive hardware and configuration. If the Array Configuration Utility discovers a physical drive that is not used, the configuration wizard leads you through the steps for adding the drive to the array.

Expanding Array Capacity

To expand your array manually:

1. Install the new physical drives.

NOTE: Always group physical drives of the same size. If you mix drive sizes, the capacity of the larger drives is wasted.

2. Assign the new physical drives to an existing array. Existing logical drives will automatically expand across the physical drives, including the newly added ones.

3. Create a new logical drive to use the extra space on the expanded array.
For this example, assume a configuration similar to the previous example, except that the fourth 9.1-GB drive is added later and Array B does not have a spare. Expand Array B to include the fourth drive. In the following figure, a single 9.1-GB drive is shown as unassigned in the main configuration screen.

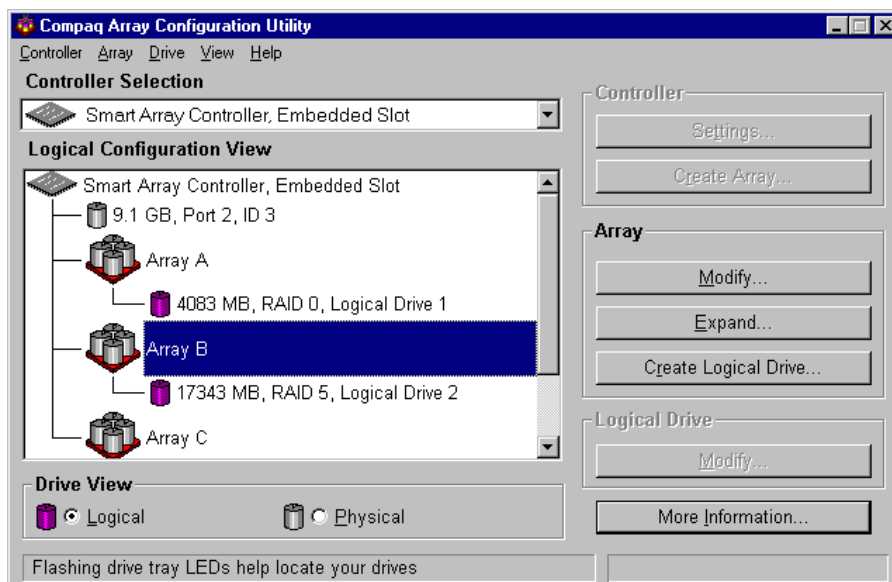


Figure 6-24. Logical Configuration View screen

To expand the capacity of Array B and create logical drive 2:

1. Select Array B.
2. Select the Expand button.
3. Select the unassigned 9.1-GB drive.
4. Select the Assign Drives to Array button.

5. Select the Next button at the bottom of the screen to advance to the Create Logical Drives screen, as shown below.

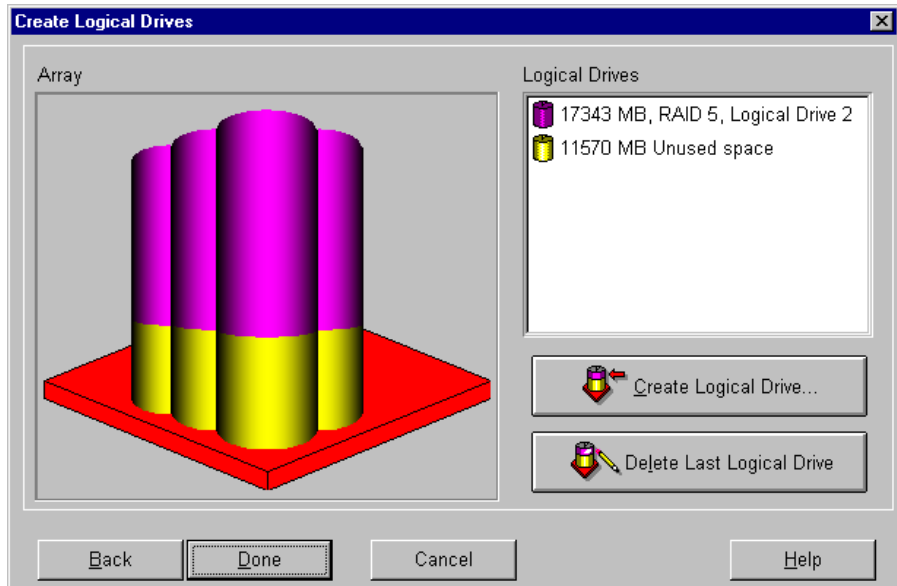


Figure 6-25. Create Logical Drives screen

6. Select the Create Logical Drive button.
7. Set the fault tolerance, array accelerator, stripe size, and size for the new logical drive.
8. Select the Done button to return to the main configuration screen.
9. At the main screen, pull down the Controller menu, then select Save Configuration from the menu bar. This saves the new settings and starts the capacity expansion process.

NOTE: The new logical drive will not be accessible until the capacity expansion process has been completed on the existing logical drive.

Capacity Extension

Logical drive extension allows you to increase the size of existing logical drives without disturbing the data on those logical drives. If an existing logical drive is full of data, you can extend the logical drive when there is free space on the array. If there is no free space on the array, you can add drives to the array and proceed to extend the logical drive.

IMPORTANT: Logical drive extension is not supported by all operating systems. You can only extend logical drives that are used with an operating system supporting capacity extension.

Operating Systems

The following operating systems support logical drive extension:

- Microsoft Windows NT 4.0 and Windows 2000
- Novell NetWare 5.0
- IBM OS/2 Warp 4.0, WarpConnect, WarpServer, WarpServer (Advanced), and WarpServer SMP
- SCO OpenServer 5, UnixWare 7, and UnixWare 2

If your operating system is not listed, check your operating system documentation or contact your operating system vendor before extending logical drives.

Extending Logical Drives

To extend the capacity of a logical drive:

1. Select the logical drive that you want to extend.
2. Pull down the Drive menu.
3. Select Extend Logical Drive.

The Extend Logical Drive screen, similar to figure below, displays the current capacity and RAID overhead of the selected logical drive.

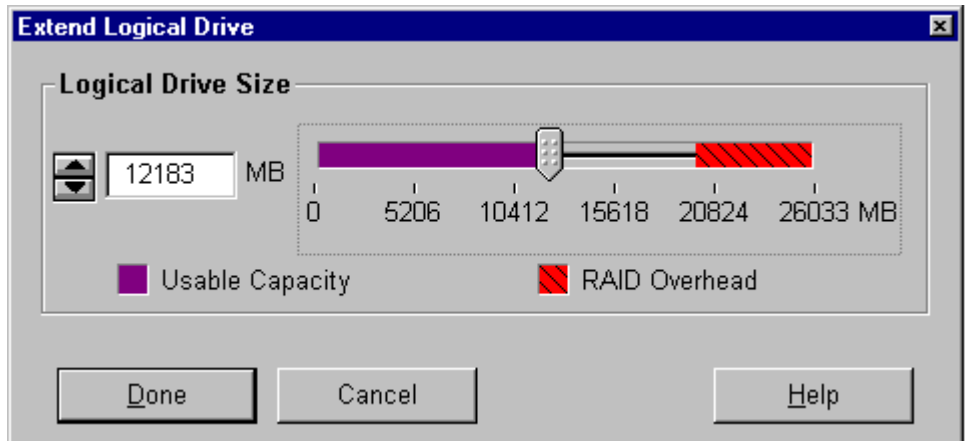


Figure 6-26. Extend Logical Drive screen

4. Move the slider control to increase or change the size of the logical drive.

NOTE: You cannot reduce the size of the logical drive from this screen.

5. Select Done.
6. Save the logical drive by selecting the Controller menu and selecting Save Configuration option.

The logical drive will be restructured so that its data will be preserved. Refer to the status gauge at the lower right of the screen to monitor the progress.

Make the extended space of the logical drive available for use by your operating system by one of the following methods:

- Create a new partition in the extended space of the logical drive by using the operating system partitioning software.
- Increase the size of existing partitions in the extended logical drive by using the operating system partitioning software or using third-party partitioning tools.

Online Migration

Use the Online RAID Level or Stripe Size Migration screen to:

- Reconfigure a currently configured logical drive to a new fault-tolerance (RAID) level
- Change an existing logical drive stripe size to a new stripe size

Both migration procedures can be done online without causing any data loss.

Online RAID Level Migration

To migrate to a different RAID level, use the following procedure:

1. Select a logical drive from the Logical Configuration View in the main configuration screen.
2. Pull down the Drive menu.
3. Select Migrate RAID/Stripe Size. A screen similar to the following figure is displayed.
4. Select the (RAID 5) Distributed Data Guarding option in the Fault Tolerance frame.
5. The stripe size can be left at the default for the selected RAID level, or set to another value. In this example, 16 KB is selected.
6. Select Done to finish.

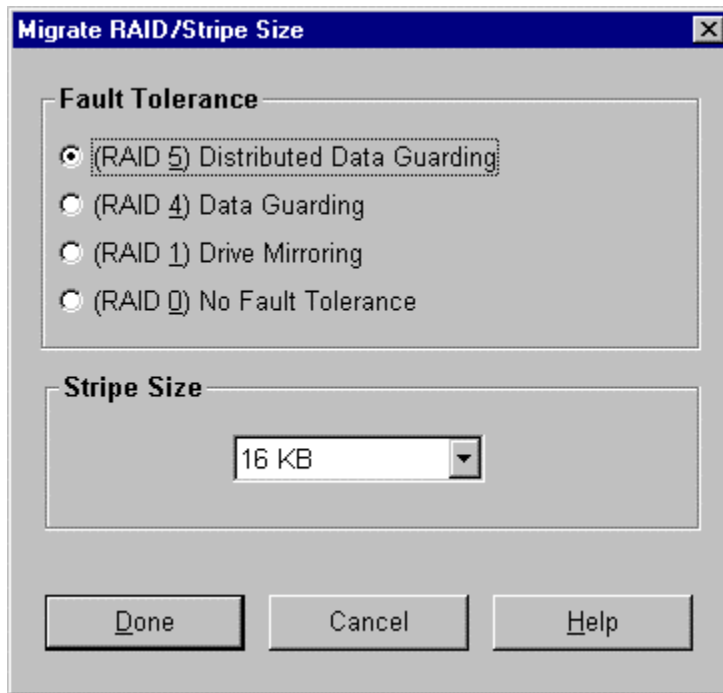


Figure 6-27. Migrate RAID/Stripe Size screen

Online Stripe Size Migration

1. Select a logical drive from the Logical Configuration View in the main configuration screen.
2. Pull down the Drive menu.
3. Select Migrate RAID/Stripe Size. A screen similar to the figure above is displayed.
4. Select the appropriate value for stripe size.
5. Select Done to finish.

Errors and Warnings

When you start the Array Configuration Utility, the software checks each controller to detect errors in its configuration. If a problem is found, the Array Configuration Utility displays an error or warning message that describes the problem. Error and warning messages include instructions for correcting the configuration errors. If you see a warning message with an error code number that says

Internal Error Has Occurred

the problem requires assistance from Compaq technical support. Refer to the “About This Guide” section at the beginning of this guide for technical support contact information.

Electrostatic Discharge

A discharge of static electricity from a finger or other conductor may damage printed circuit boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.

Preventing Electrostatic Damage

To prevent electrostatic damage, observe the following precautions:

- Avoid hand contact by transporting and storing parts in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free work stations.
- Place parts on a grounded surface before removing them from their container.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when touching a static-sensitive component or assembly.

Grounding Methods

There are several methods for grounding. Use one or more of the following measures when handling or installing electrostatic-sensitive parts:

- Use a wrist strap connected by a ground cord to a grounded workstation or the computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm +/- 10 percent resistance in the ground cords.
- Use heel straps, toe straps, or bootstraps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats.
- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

If you do not have any of the suggested equipment for proper grounding, request that a Compaq authorized service provider install the part.

NOTE: For additional information on static electricity, or assistance with the installation of this product, contact your Compaq authorized service provider.

Appendix **B**

Understanding Drive Arrays

This chapter provides explanations of drive array concepts, data protection methods, including fault-tolerance options, and data reliability features of the Integrated Smart Array Controller. Before you configure your Integrated Smart Array Controller, review the following general information so that you are familiar with the terms and concepts required for configuration.

What is a Drive Array?

A drive array is simply a collection of hard disk drives or *physical drives* that are grouped together to create an *array* of physical drives. An array is made up of one or more subsets called *logical drives* (sometimes called logical volumes), which are spread across all physical drives in the array. Operating systems view logical drives as a single, contiguous storage space although it is made up of parts of several physical drives.

The generic drive array illustrated in the first figure below consists of two logical drives spread across three physical drives. The following three figures illustrate other drive array configurations.

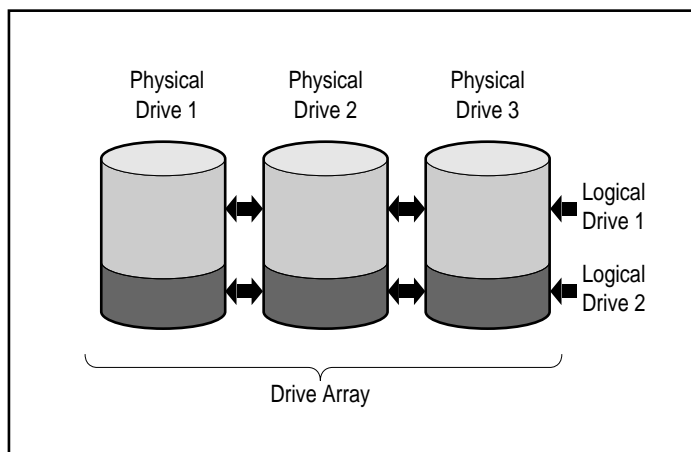


Figure B-1. Drive array with two logical drives and three physical drives

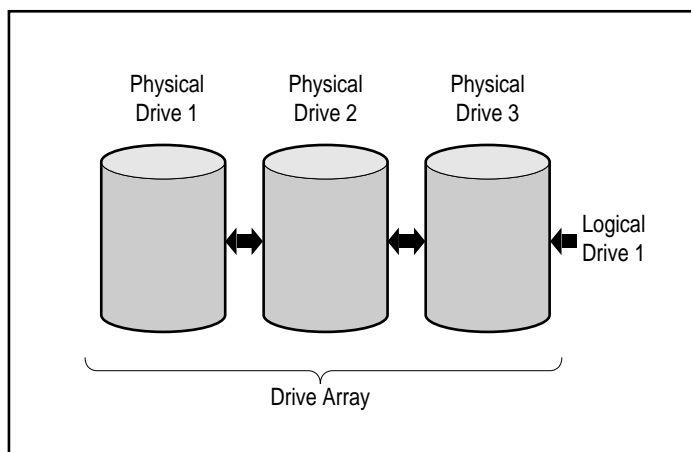


Figure B-2. Drive array with one logical drive and three physical drives

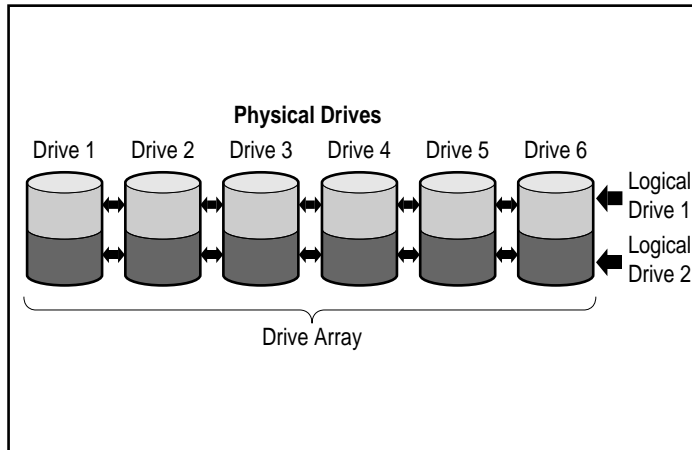


Figure B-3. Drive array with two logical drives and six physical drives

The same physical drives may also be arranged into separate arrays as illustrated in the figure below. Both arrays can be managed by the same controller.

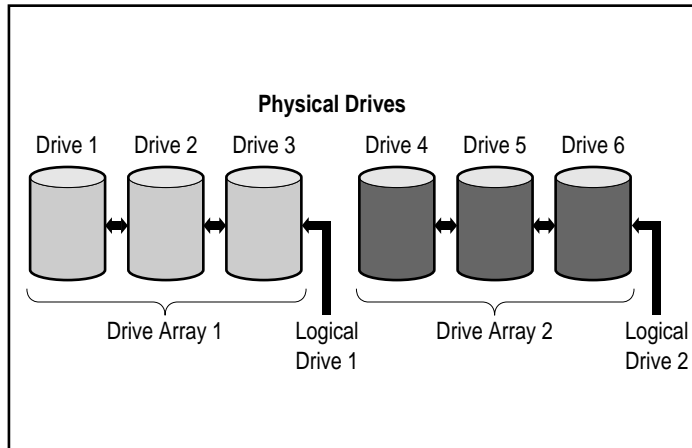


Figure B-4. Two drive arrays with six physical drives

Drive Arrays

Drive arrays on the Integrated Smart Array Controller have several important attributes:

- A single array cannot span more than one Integrated Smart Array Controller.
- A single Integrated Smart Array Controller can control multiple arrays.
- Arrays must have at least one and may have up to 15 physical drives.
- Arrays consist of at least one and may have up to 32 logical drives with a maximum of 32 logical drives per controller.
- For maximum space efficiency, all drives in a single array should be of the same capacity.

Logical Drives

The concept of logical drives is an important one. A logical drive is storage space that is distributed across *all* physical drives in an array (except for online spares). Distributing storage space provides efficiency and security:

- Data can be accessed on all physical drives at once, resulting in much higher performance data storage and retrieval.
- Fault-tolerance methods can be used to protect your data against hardware failures.

An array can consist of several logical drives, each spanning all of the physical drives in the array. It is important to note that the part of any one logical drive residing on each physical drive is the same size. This means that for maximum space efficiency, all physical drives in each array should also be the same size.

Logical drives have these important attributes:

- There must be at least one and up to 32 logical drives in an array (maximum 32 logical drives per controller).
- Logical drives in an array may have different individual storage capacities.
- Logical drives in an array may use different fault-tolerance or RAID methods.
- The portion of a logical drive on each physical drive is the same size.

Drive Array Benefits

Using drive arrays with the Integrated Smart Array Controller has several important benefits:

- Data protection
- Performance enhancement
- Capacity changes
- Drive movement
- Data reliability

Data Protection

The Integrated Smart Array Controller provides several options for producing data redundancy in a more reliable system, including distributed data, fault-tolerance methods, assigning online spares, and rebuilding data automatically to online spare drives.

Fault-Tolerance (RAID) Options

During configuration, you will make RAID (Redundant Arrays of Inexpensive Disks) level choices. RAID is a term used for an array technology that provides data redundancy to increase system reliability and performance.

There are several RAID levels ranging from RAID 0 to RAID 5. The Integrated Smart Array Controller provides the following levels of RAID:

- RAID 0
 - No fault tolerance (data striping for performance only)
- RAID 1
 - Drive mirroring
- RAID 0+1
 - Drive striping and mirroring
- RAID 5
 - Distributed data guarding

The fault-tolerance method you choose affects the amount of available disk storage capacity and the performance of your drive array. The following table lists all supported RAID levels for Integrated Smart Array Controller, and it illustrates how the fault-tolerance method you select affects performance and capacity.

Table B-1
RAID Level Characteristics

	Distributed Data Guarding (RAID 5)	Mirroring (RAID 1)	No Fault Tolerance (RAID 0)	Striping and Mirroring (RAID 0+1)
Usable Disk Space*	67% to 93 %	50%	100%	50%
Disk Space Formula (n = no. of drives) where: n is the number of drives in the array (up to 15)	$(n-1)/n$	$n/2$	n	$n/2$
Parity and Data Redundancy	Parity distributed over each drive	Duplicate data	None	Duplicate data
Minimum Number of Drives	3	2	1	4
Comments	Tolerant of single drive failures. Uses the least amount of storage capacity for fault tolerance.	Tolerant of multiple, simultaneous drive failures.** Higher performance than RAID 5. Uses the most storage capacity for fault tolerance. Requires an even number of drives.	Best performance, but data is lost if any drive in the logical drive fails. Uses no storage space for fault tolerance.	Tolerant of multiple, simultaneous drive failures.** Higher performance than RAID 5. Uses the most storage capacity for fault tolerance. Requires an even number of drives
* All drives have the same capacity ** As long as failed drives are not mirrored to each other.				

If you require a fault-tolerant system for critical data, use RAID 5 for maximum storage space efficiency or RAID 1 if maximum performance and redundancy are critical.

If you are storing noncritical data, and both space and performance are both important, RAID 0 provides the best option.



CAUTION: RAID 0 has no data protection. You must rely on backups in case of hardware failure on drives with no fault tolerance.

Distributed Data Guarding (RAID 5)

Distributed data guarding, also called RAID 5, stores parity data across all the drives in the array. Spreading the parity across all the drives allows simultaneous read. If a drive fails, the controller uses the parity data and the data on the remaining drives to reconstruct data from the failed drive. This allows the system to continue operating with a slightly reduced performance until you replace the failed drive.

Distributed data guarding requires an array with a minimum of three physical drives and allows a maximum of 15 drives. Therefore, in an array containing three physical drives, distributed data guarding uses only 33 percent of the total logical drive storage capacity for fault tolerance, while a 15-drive configuration uses only 7 percent.

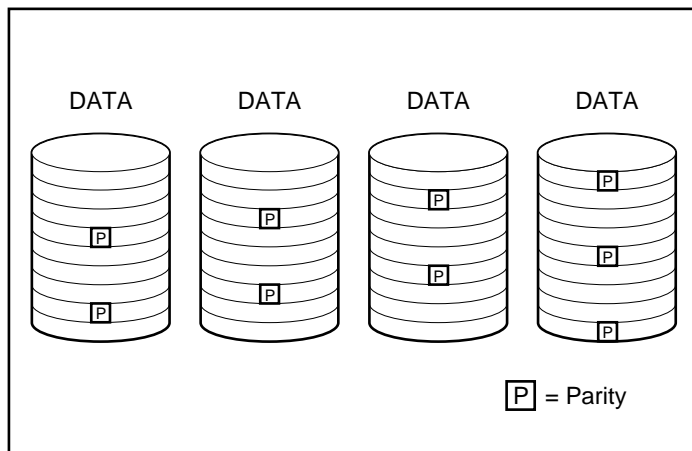


Figure B-5. Distributed data guarding distributes the redundant data [P] throughout the physical drives

Drive Mirroring and Striping (RAID 1 and RAID 0+1)

Drive mirroring, also called RAID 1, is the highest performance and highest fault-tolerance RAID method. RAID 1 is the only option offering fault-tolerance protection if only two drives are installed or selected for an array. Drive mirroring creates fault tolerance by storing two sets of duplicate data on a pair of disk drives. Therefore, RAID 1 is the most expensive fault-tolerance method because 50 percent of the drive capacity is used to store the redundant data. RAID 1 always requires an even number of drives. To improve performance in configurations with four or more drives, the data is striped across the drives and then mirrored. This is also referred to as RAID 0+1.

If a drive fails, the mirror drive provides a backup copy of the files and normal system operations are not interrupted. The mirroring feature requires a minimum of two drives and, in a multiple drive configuration (four or more drives), mirroring can withstand multiple simultaneous drive failures as long as the failed drives are not mirrored to each other. If two drives mirrored to each other fail, the volume is failed and data loss may occur.

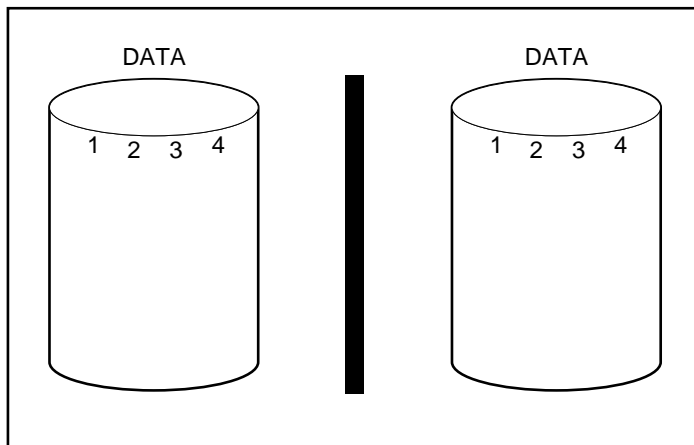


Figure B-6. Drive mirroring stores an identical copy of the data

No Fault Tolerance (RAID 0)

RAID 0 does not provide fault tolerance. This level of RAID stripes data across all the drives of the array, but it does not incorporate a method to create redundant data. Therefore, if you choose this RAID option for any of your logical drives, you will experience complete data loss for that logical drive if one physical drive fails.

However, because none of the capacity of the logical drives is used for redundant data, RAID 0 offers the best processing speed and capacity. For this reason, you may consider assigning RAID 0 to drives that require large capacity and high speed but do not contain critical data.

Before choosing the RAID 0 option, be sure to consider the following:

- Disk failure will result in data loss for all RAID 0 logical drives.
- You cannot assign an online spare to an array containing a RAID 0 logical drive.

Online Spares

During configuration, Compaq recommends assigning an online spare to further improve your system's fault tolerance. An online spare (sometimes called a hot-spare) is a drive the controller uses when a drive failure occurs. If a drive fails, the controller rebuilds the data that was on the failed drive onto the online spare. The controller also sends data that it would normally store on the failed drive directly to the online spare.

The online spare improves the overall system fault tolerance by automatically replacing a failed drive and quickly restoring the system to full RAID fault-tolerance protection.

NOTE: During the time the system is operating in interim recovery mode with the failed drive, the system is vulnerable to an additional drive failure just as it would be without a spare drive installed.

You can install up to five online spares for each Integrated Smart Array Controller. To provide an online spare, you must have at least one installed but unassigned physical drive and the system must be running some type of fault-tolerance method (RAID 1 or RAID 5).

Spare drives are assigned to all logical drives in an array automatically and can be assigned to multiple arrays connected to the same controller.

Performance Enhancement

Drive arrays allow data access performance to be enhanced dramatically over nonarrayed drives. In addition, the Integrated Smart Array Controller has several other performance enhancement features that are discussed here.

Distributing Data and Data Striping

Distributing data makes it possible to access data concurrently from multiple drives in an array. This yields I/O rates many times faster than nonarrayed drives. Distributing data allows data striping as shown in the following figure.

Data striping is automatically generated on an array controller in order to store user data. A stripe is a collection of contiguous data that is distributed evenly across all physical drives in a logical drive. The width of the stripe (the amount stored on each physical drive) is selected to optimize the performance of the operating system.

For example, consider an operating system that typically requests data in 32-sector blocks. The Integrated Smart Array Controller distributes the data so that the first 32 sectors of data are on the first drive in the array. The Integrated Smart Array Controller continues distributing the next 32 sectors on the second drive, the next 32 sectors on the third drive, and so on. Evenly distributed data results in improved performance by allowing data access to all drives simultaneously.

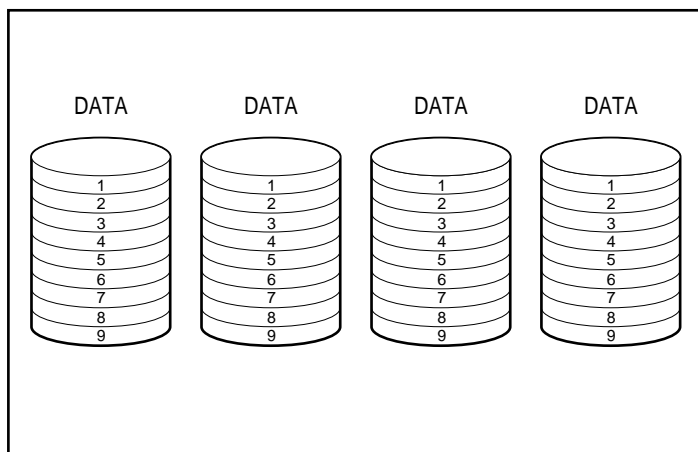


Figure B-7. Data striping distributes data across all physical drives

Concurrent I/O Request Servicing

The Integrated Smart Array Controller has the capability to service hundreds of I/O requests at a time. For example, if you request data that resides on the first drive and another user requests data that resides on the second drive, the controller can deliver both pieces of information concurrently. The following figure illustrates concurrent request servicing.

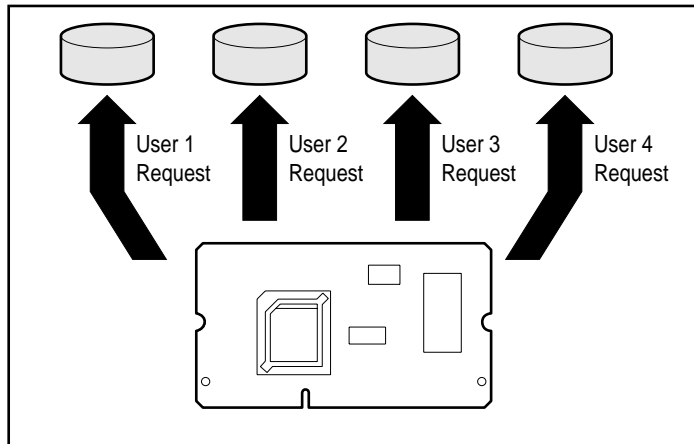


Figure B-8. Concurrent request servicing handles several I/O requests

Optimized Request Management

Optimized request management, also known as **elevator trend sorting**, is another performance enhancement feature provided by the Integrated Smart Array Controller. The controller receives and queues multiple data requests from the operating system. The controller then rearranges the requests in an order that optimizes performance.

To illustrate this concept, imagine the Integrated Smart Array Controller receives a request for a physical drive that is not currently active. The controller schedules the request immediately ahead of previously received requests already queued to other active drives within the array. This request management process operates concurrently with drive operations. The benefits of optimized request management increase as greater demands are made on the drive subsystem.

Bus Master Data Transfers

The Integrated Smart Array Controller is a bus master device that takes control of the PCI bus during high-speed transfers. This allows the system processor to handle application processing or other types of tasks. Data transfer occurs at rates of up to 132 MB/s on the PCI bus. Bus master high-speed transfers are particularly important when the supported models are used in conjunction with multiple expansion boards such as network interface controllers (NICs).

Adding Storage Capacity

Storage capacity can be increased in two ways:

- Capacity Expansion—Adding physical drives and creating new logical drives.
- Capacity Extension—Adding physical drives and growing the existing logical drive (without adding new logical drives).

Array Configuration Utility will allow users to extend (increase) the size of existing logical drives under any operating system. However, only Windows NT 4.0 and OS/2 allow the user to resize a partition inside the extended (bigger) logical drive using third party tools like Power Quest's Partition Magic (version 3.0 or later).

NOTE: Extending the capacity of an existing logical drive can be done off-line by backing up all data, reconfiguring the array, and restoring the data. To extend capacity online, your operating system must support a logical drive increasing in size.

The Integrated Smart Array Controller allows the configuration of one or more separate logical drives into a single drive array. The controller also supports extending the capacity of an existing logical drive. An existing drive array can be expanded by adding one or more logical drives to the array or by growing the capacity of an existing logical drive. To create the room for the additional capacity, more physical drives must be added, as shown in the following figure.

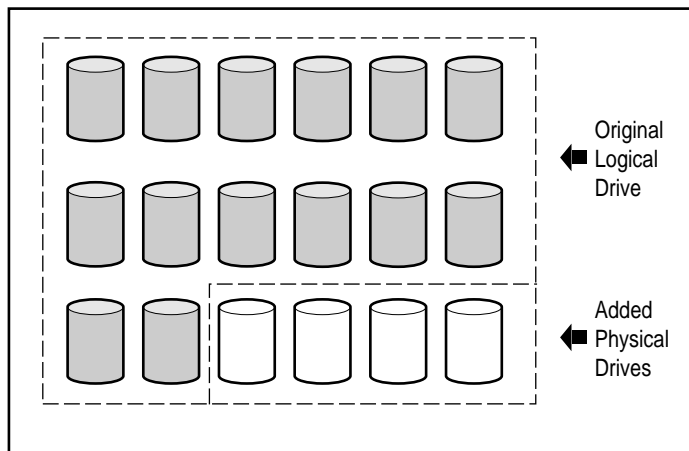


Figure B-9. Adding more physical drives

When initiated by the Array Configuration Utility, the Integrated Smart Array Controller automatically redistributes the data in the original logical drive to a logical drive that spans all of the physical drives in the array, including the added drives. The room left over is used to increase the size of a logical drive or create additional logical drives, also spanning all physical drives. The extended logical drive is within the larger drive array. When logical drives are added, both logical drives are then included in the drive array with expanded storage capacity, as shown in the following figure.

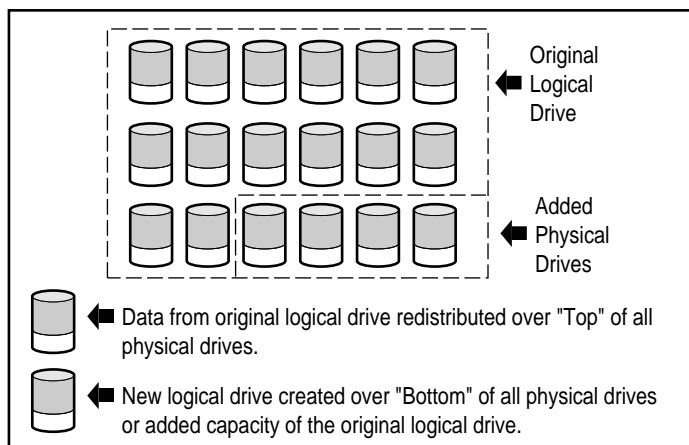


Figure B-10. Expanded array storage capacity with a second logical drive

Example: Assume that you have a total of 14 drives and you want to expand this to 18 drives. With Array Configuration Utility running, simply install four matching drives in the empty drive bays. At this point your array resembles Figure B-9, with the original data (original logical drive) represented by the gray shaded drives and the new drives unshaded. Run the Array Configuration Utility, which is located on the Compaq SmartStart and Support Software CD, to start the expansion process described in Chapter 6.

The Integrated Smart Array Controller redistributes the data to an equal portion of all the drives, using the same fault-tolerance method as the original configuration. The first logical drive remains first, but it now spans 18 drives instead of 14. The Array Configuration Utility also detects the unused space on each drive (because each drive contains 14/18ths of the data that it used to) and helps you configure it into a second logical drive with its own fault tolerance, distributed over the extra space of all the drives.

When this process is finished both logical drives, one containing the original data and the new empty one, are configured into a single array with total capacity than the original one. Now your array will resemble Figure B-10, using the same shading scheme to represent the logical drives.

It is not necessary for all *logical drives* in an array to be the same size or even have the same fault-tolerant configuration. Each logical drive is treated as a separate entity no matter how many physical drives it crosses. Each may be configured as best suits your needs.

It is important to remember that all *physical drives* in an array should be the same size (capacity), because each drive contains an equal portion of one or more logical drives, and the portion sizes can only total the size of the smallest drive. While you are not prevented from expanding storage capacity with larger drives, the extra space cannot be used.

During expansion of an array with two or more logical drives, the redistribution of data takes place one logical drive at a time. When the capacity expansion has completed, any newly created logical drive becomes available. Under Windows NT and Novell NetWare, the new logical drive can be appended to your existing logical volume.

Online Capacity Expansion or Extension

In certain cases, the Integrated Smart Array Controller and the Array Configuration Utility also support making storage capacity changes online, without taking the server or storage system offline. These features are available if the network has both:

- Windows NT or Novell NetWare operating systems
- Hot-plug hard drives

NOTE: Online capacity extension is available under Windows NT only.

Because the Array Configuration Utility reconfigures the Integrated Smart Array Controller, online reconfiguration can only take place if Array Configuration Utility is running in the same environment as the normal server applications.

Hot-plug drives are required for online storage changes because non-hot-plug drives require that the server be powered down to add or remove the drive. All storage systems support hot-plug drives.

Disk Drive Capacity Upgrades

Additional storage space may be obtained with the same number of physical drives *in a fault-tolerant configuration* by replacing these drives with others of higher capacity. By replacing the drives one at a time, the data on the new drive is re-created from redundant information on the remaining drives. After each new drive has been rebuilt, the next can be replaced. After all drives have been replaced and rebuilt, the additional capacity on each drive can be used by adding a new logical drive. The Array Configuration Utility recognizes the unused space (with RAID 1, 0+1, and 5) and guides you through the configuration procedures.

Data Reliability

The Integrated Smart Array Controller and the network operating system offer several other fault-management and data-reliability features. These features include:

- Auto reliability monitoring
- Dynamic sector repairing
- Drive parameter tracking
- Drive failure alert features
- Interim data recovery
- Automatic data recovery
- Hot-plug drives (on Compaq servers and storage systems supporting hot-plug drives)

The following are not Integrated Smart Array Controller features, but may be functions supported by the operating system:

- Controller duplexing
- Software-based drive mirroring

Auto Reliability Monitoring

Auto reliability monitoring (ARM) is a background process that scans hard drives for bad sectors in fault-tolerant logical drives. ARM also verifies the consistency of parity data in drives with data guarding or distributed data guarding. This process assures that you can recover all data successfully if a drive failure occurs in the future. ARM operates only when you select RAID 1 or RAID 5.

Dynamic Sector Repairing

Using the dynamic sector repairing process, the controller automatically remaps any sectors with media faults it detects either during normal operation or during auto reliability monitoring.

Drive Parameter Tracking

Drive parameter tracking monitors more than 15 drive operational parameters and functional tests. This includes parameters such as read, write, and seek errors, spin-up time, cable problems, and functional tests such as track-to-track seek time, one-third stroke, and full-stroke seek time. Drive parameter tracking allows the Integrated Smart Array Controller to detect drive problems and predict drive failure before they actually occur. This function also makes prefailure warranty possible on Compaq disk drives.

Drive Failure Alert Features

Drive failure features produce various drive alerts or error messages depending on the Compaq server model. Refer to the documentation included with your server to determine which drive failure features are included on your server model.

Other Compaq options such as Compaq Insight Manager and Compaq Server Manager/R provide additional drive failure features. See your Compaq authorized reseller for more information on these products.

Interim Data Recovery

In RAID 5 or RAID 1 fault-tolerant configurations, if a drive fails, the system continues to operate in an interim data-recovery mode. For example, if you had selected RAID 5 for a logical drive with four physical drives and one of the drives fails, the system continues to process I/O requests, but at a reduced performance level. Replace the failed drive as soon as possible to restore performance and full fault tolerance for that logical drive.

Automatic Data Recovery

After you replace a failed drive, automatic data recovery reconstructs the data and places it on the replaced drive. This allows a rapid recovery to full operating performance without interrupting normal system operations.

In general, the time required for a rebuild is approximately 15 minutes per gigabyte. The actual rebuild time, however, is dependent upon the Rebuild Priority set, the amount of I/O activity occurring during the rebuild operation, the number of drives in the array (RAID 5) and the disk drive speed.



CAUTION: You must specify RAID 5 or RAID 1 through the Array Configuration Utility to make the recovery feature available. The drive failure alert system and automatic data recovery are functions of the Integrated Smart Array Controller; they operate independently of the operating system.

Hot-Plug Drives

The Integrated Smart Array Controller supports hot-plug drives when used with a Compaq ProLiant Storage System/U (Models U1, U2, or UE), a Rack-Mountable Compaq ProLiant Storage System/U, a Compaq ProLiant Server, a Rack-Mountable Compaq ProLiant Server, an Enclosure Model 4214R, or an Enclosure Model 4214T. You can install or remove these drives without turning off the system power. This feature is a function of the servers mentioned above, and operates independently of the operating system.



CAUTION: Do not turn off the Compaq storage system server when removing or installing the hot-plug replacement drives. If you turn off the storage system while the server power is on, the Integrated Smart Array Controller marks all the drives as “failed.” This could result in permanent data loss when the storage system is turned back on.

Refer to the previous and next figure for conditions to safely replace a drive using the three indicators on each of the hot-plug drive trays.

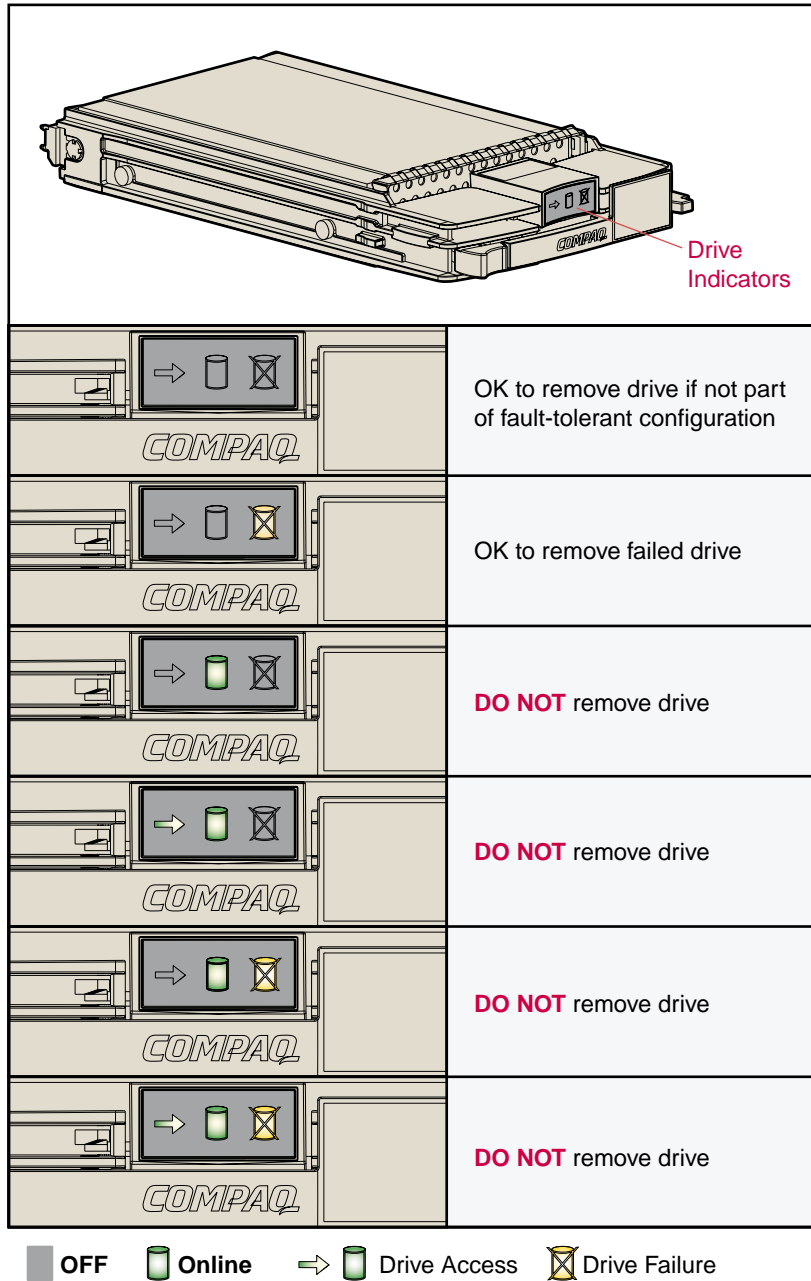


Figure B-11. Hot-plug drive replacement conditions for Wide Ultra2 SCSI hot-plug drives

Software-Based Drive Mirroring

IMPORTANT: Compaq strongly recommends using hardware-based fault tolerance instead of software-based fault tolerance. Hardware-based fault tolerance provides a much more robust and controlled environment for fault-tolerance protection.

Some operating systems support software-based drive mirroring as a fault-tolerance feature. Software drive mirroring resembles hardware-based drive mirroring (RAID 1), except that the operating system mirrors logical drives instead of physical drives.

A pitfall of software-based drive mirroring is that the operating system believes each logical drive is a separate physical drive. If you mirror logical drives in the same array and a physical drive fails, both logical drives in the mirrored pair will fail and you will not be able to retrieve your data.

Software-based drive mirroring is a function of the operating system. Refer to the documentation included with your operating system for instructions on implementing this feature.

For more information on hardware versus software fault tolerance, consult the white paper section of the Compaq Storage website:

<http://www.compaq.com/support/techpubs/whitepapers/>

Recovering from Drive Failure

The purpose of fault-tolerant configurations on the Integrated Smart Array Controller is to protect against data loss due to drive failure. Although the Integrated Smart Array Controller firmware is designed to protect against normal drive failure, it is imperative that the system operator perform the correct actions to recover from a drive failure without inadvertently inducing any additional drive failures.

Multiple drive failures in the same array generally result in data loss; exceptions include failures following activation of a spare drive, and failure of drives in a mirroring configuration that are not mirrored to one another.

Recognizing a Drive Failure

A drive failure can be recognized by the system operator in one of several ways:

- Amber LED will be illuminated on failed drives in a hot-plug tray. This, however, assumes the storage system is powered on and the SCSI cable is working. Note that the amber LED may be illuminated briefly when a hot-plug drive is inserted; this is normal.
- Amber LED on the front of a ProLiant Storage System will be illuminated if failed drives are inside (other problems such as fan failure or over-temperature conditions will also cause this LED to be illuminated).
- A Power-On Self-Test (POST) message will list failed drives whenever the system is restarted (assumes that one or more “good” drives are detected by the controller).
- Array Diagnostics Utility (ADU) will list all failed drives. An online version on ADU is also available in Windows NT environments.
- Compaq Insight Manager can be used to detect failed drives remotely across a network.

Problems such as reduced system performance or disk errors reported by the operating system do not necessarily imply that a drive has or has not been failed. If you suspect drive failures or encounter repeated errors, Compaq recommends that you run Drive Array Advanced Diagnostics on the system.

Fault Tolerance and Drive Failure

In case of a drive failure, the condition of the logical drive will vary depending upon the fault-tolerance method used. Because a single array of physical drives can contain multiple logical drives with different fault-tolerance methods, conditions of each logical drive on the same array are not necessarily the same. At any one time, if more drives are failed than the fault-tolerance mode allows, fault tolerance is referred to as being “compromised” and the condition of the logical drive can be referred to as “failed.” If a logical volume is “failed,” all requests from the operating system will be rejected with “unrecoverable” errors.

A RAID 0 (Non-Fault-Tolerant) Logical Drive

Non-fault-tolerant logical drives cannot sustain drive failures. If any physical drive in the array fails, the condition of all non-fault-tolerant logical drives in the same array is also logged as “failed” because data is striped across all drives in the array.

A RAID 1 (Mirroring) Logical Drive

RAID 1 logical drives:

- Can sustain multiple drive failures as long as failed drives are not mirrored to one another.
- Will be in a “failed” condition if any two failed drives are mirrored to one another.
- Will be in a “regenerating” condition if at least one drive is failed, and no failed drives are mirrored to one another.
- Will be in a “rebuilding” condition if a previously failed drive has been replaced and the replacement drive is rebuilding. The volume may also be in a “rebuilding” condition following a drive failure if a spare drive was previously assigned and is rebuilding.
- In any RAID 1 logical drive on the Integrated Smart Array Controller having N physical drives in the array (not including spare drives), the first N/2 physical drives are normally mirrored in consecutive order to the second N/2 physical drives. When determining the order, number each drive in the array by increasing IDs on the SCSI bus.

A RAID 5 (Distributed Data Guarding) Logical Drive

RAID 5 logical drives:

- Can sustain a single drive failure. The logical drive will be in a “regenerating” condition if one drive is failed.
- Will be in a “failed” condition if more than one drive is failed.
- Will be in a “rebuilding” condition if a previously failed drive has been replaced and the replacement drive is rebuilding. The volume may also be in a “rebuilding” condition following a drive failure if a spare drive was previously assigned and is rebuilding.

Spare Drives

In case of a drive failure, if a spare drive is assigned and available, the spare drive acts as an immediate replacement for the failed drive. Data is automatically reconstructed from the remaining drives in the volume and written to the spare drive via the Automatic Data Recovery process. Once the spare drive is completely built, the logical drive is again running at full fault tolerance, and is then able to sustain another subsequent drive failure. Note, however, that if another drive were to fail before the spare drive is completely built, the spare drive cannot prevent failure of the entire logical drive. Also, note the possibility that non-correctable disk errors can prevent completion of the Automatic Data Recovery process.

Replacing a Failed Drive

Failed drives in hot-plug trays can be removed and replaced while host system and storage system power is in Off/Standby mode. Hot-plug drives can also be replaced when the power is Off.



CAUTION: Never turn off an external storage system while the host system power is on because all drive will fail and fault tolerance will likely be compromised.

When a hot-plug drive is inserted, all disk activity on the controller will be temporarily paused while the drive is spinning up (usually 20 seconds or so). If the drive is inserted while power is On, in fault-tolerant configurations, recovery of data on the replacement drive will automatically begin (indicated by blinking online LED).

Before replacing non-hot-plug drives, ensure that system power is Off. On all non-hot-plug drives, be sure to check the SCSI ID jumpers to make sure that the correct drive is being replaced.



CAUTION: Replacing the wrong physical drive may compromise fault tolerance and result in data loss.

Also, be sure that the SCSI ID jumpers are set to the same SCSI ID on the replacement drive. Note that the SCSI ID jumpers may be located at different places on different drive models.



CAUTION: Always set the SCSI ID on the replacement drive to the same value as the original failed drive. Failure to do this could result in SCSI ID conflicts that compromise fault tolerance and result in a loss of data.

The capacity of replacement drives must be at least as large as the capacity of the other drives in the array. The controller will immediately fail a replacement drive with insufficient capacity, and Automatic Data Recovery will not start.



CAUTION: If the Integrated Smart Array Controller has a failed drive, replace the drive with a new or known-good replacement drive. In some cases, a drive that has previously failed by the controller may appear to be operational after the system is power-cycled, or after removal and reinsertion of a hot-plug drive. However, this practice is highly discouraged as the use of such “marginal” drives may eventually result in data loss.

Automatic Data Recovery

If a drive in a fault-tolerant configuration is replaced while the system power is on Standby, the controller will display a Power-On Self-Test (POST) message during the subsequent system startup. This indicates that the replacement drive has been detected and that Automatic Data Recovery may need to be started. Press **F1** to initiate the background Automatic Data Recovery process. If Automatic Data Recovery is not enabled, the logical drive remains in a “ready to recover” state, and the same query displays the next time the system starts.

Replacement drives are not considered to be “online” until Automatic Data Recovery is completed, at which time the online LED stops blinking and is on “solid.” Any drives that are not yet “online” are treated as if they are “failed” when trying to determine whether fault tolerance will be compromised. For example, in a RAID 5 logical drive with no spare and one drive rebuilding, another drive failure at this time would result in a “failure” condition for the entire logical drive.

In general, the time required for a rebuild is approximately 15 minutes per gigabyte. The actual rebuild time, however, is dependent upon the Rebuild Priority set, the amount of I/O activity occurring during the rebuild operation, the number of drives in the array (RAID 5) and the disk drive speed.

Automatic Data Recovery Failure

During Automatic Data Recovery, if the online LED of the replacement drive stops blinking and all other drives in the array are still online, the Automatic Data Recovery process may have been terminated abnormally because of a noncorrectable read error from another physical drive during the recovery process. The background Auto-Reliability Monitoring process is intended to help prevent this problem, but it cannot do anything about certain issues, such as SCSI bus signal integrity problems. Restart the system. A POST message will confirm the diagnosis. Retrying Automatic Data Recovery may help. If the retry does not help, the recommended course of action is a backup of all data on the system, a surface analysis (with user diagnostics tools), and a full restore.

During Automatic Data Recovery, if the online LED of the replacement drive stops blinking and the replacement drive is failed (amber failure LED illuminated or other LEDs go out), the replacement drive is producing unrecoverable disk errors. In this case, the replacement drive should be removed and replaced with another replacement drive.

Compromised Fault Tolerance

If fault tolerance is ever compromised because of failure of multiple drives, the condition of the logical drive will be “failed” and “unrecoverable” errors will be returned to the host. Data loss is probable. Insertion of replacement drives at this time will not improve the condition of the logical drive. If this occurs, first try turning the entire system off and on. In some cases an intermittent drive will appear to work again (perhaps long enough to make copies of important files) after cycling power. If a 1779 POST message displays, press **F2** to reenable the logical drive(s). Remember that data loss has likely occurred and any data on the logical drive is suspect.

Fault tolerance may be compromised because of nondrive problems such as a faulty cable, faulty storage system power supply, or a user accidentally turning off an external storage system while the host system power was on. In such cases, obviously the physical drives do not need to be replaced. However, data loss can still occur in this situation, especially if the system was busy at the time the problem developed.

In cases of legitimate drive failure, once copies of important data have been made (if possible), replace any drives that have failed to prevent further drive problems in the future. After these (multiple) drives are replaced, the fault tolerance may again be compromised, power may need to be cycled, and the 1779 POST message may again be displayed. Press **F2** to reenable the logical drives, re-create your partitions, and restore all data from backup.

Because of the risk that fault tolerance may be compromised at some point in the future, make regular backups of all logical drives.

Appendix **C**

Questions and Answers

This section contains several common questions and answers about the Integrated Smart Array Controller. Where indicated, use the Documentation CD, SmartStart and Support Software CD, and other user documentation provided with your server or option kit as reference sources. Additional information about Compaq hardware and services is available on the Compaq website:

<http://www.compaq.com>

Q. Does the Integrated Smart Array Controller support SCSI tape drives and CD-ROM Drives?

- A. Yes. The Integrated Smart Array Controller supports Wide Ultra2 SCSI and Wide-Ultra SCSI-3 hard drives, as well as tape drive formats such as DLT, DAT, SLR, and AIT.

Q. I installed the hard drives in my server. Must I now terminate each drive?

- A. No. If you installed hard drives in a server with an Integrated Smart Array Controller, all termination requirements are met by the controller and the SCSI signal cable. Therefore, the individual drives should have termination removed.

Q. I have several hard drives in my hot-plug drive cage. What SCSI IDs do I assign for these drives?

- A. Each hard drive must have a unique SCSI ID for *each* controller port. If your drives are installed in a Compaq ProLiant Server, a Rack-Mountable Compaq ProLiant Server, a Compaq ProLiant Storage System/U (Models U1, U2, or UE), or Enclosure 4214R/4214T, the SCSI IDs do not need to be set manually. For this equipment, the SCSI IDs are *automatically* set according to the bay in which the drives are installed.

Q. Should SCSI IDs in my system be consecutive?

- A. No. The IDs of devices on each SCSI bus are not required to be consecutive. However, IDs must be unique for each device on a single SCSI bus.



CAUTION: Do not interchange SCSI IDs after you configure your Integrated Smart Array Controller. Interchanging the SCSI IDs will result in loss of data.

Q. I ordered my server with a preinstalled Integrated Smart Array Controller. Will the server ship with the SCSI cable that I will need to connect to my Compaq ProLiant Storage System/U (Model U1, U2, or UE)?

- A. No, you will not receive the external SCSI cable with your server. However, the required cable is supplied with Compaq ProLiant Storage System/U enclosure.

Q. How do I use the System ROMPaq?

- A. You should use System ROMPaq to upgrade the firmware in your server to the latest revisions prior to installing an Integrated Smart Array Controller in an existing server. For details, see Chapter 3.

Q. What must I do if I do not understand the POST error message referring to the Integrated Smart Array Controller?

- A. First, copy down the POST error message for later reference. A list of POST error messages and definitions is available in the maintenance and service guide for your server or at Compaq's website:

<http://www.compaq.com>

At the website, locate your software in the Support area.

After you have defined the error, take the required corrective steps. If you still do not know what to do, run the Array Diagnostic Utility.

Q. Can I use third-party (non-Compaq) drives on the Integrated Smart Array Controller?

- A. Although you *can* use third-party drives, experience in Compaq testing laboratories reveals that you might have problems, including time-outs and data corruption.

Q. Can I get Pre-Failure Warranty with third party drives?

- A. No. Compaq can support only Pre-Failure Warranty through its own tested, integrated storage solutions, and the Compaq Insight Manager utility.

Q. Why do the drive activity lights light up on some drives when my system is idle?

- A. The Integrated Smart Array Controller performs several different background activities on the drives when the controller is otherwise idle. For example, the Auto Reliability Monitoring task scans fault-tolerant volumes for defects and verifies the consistency of parity data. The Drive Parameter Tracking task periodically checks the performance of all drives on the controller, normally on an hourly basis.

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